FEBRUARY, 1952

APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER TRANSMISSION

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PRESSURE SWITCH CONTROLLED BOOSTER CIRCUIT PAGE 29

FLUID DRIVE IN CONSTRUCTION EQUIPMENT PAGE 36

BEGINNER'S COURSE IN BASIC PNEUMATICS PAGE 65

HOW TO KEEP OIL SYSTEM CLEAN PAGE 71

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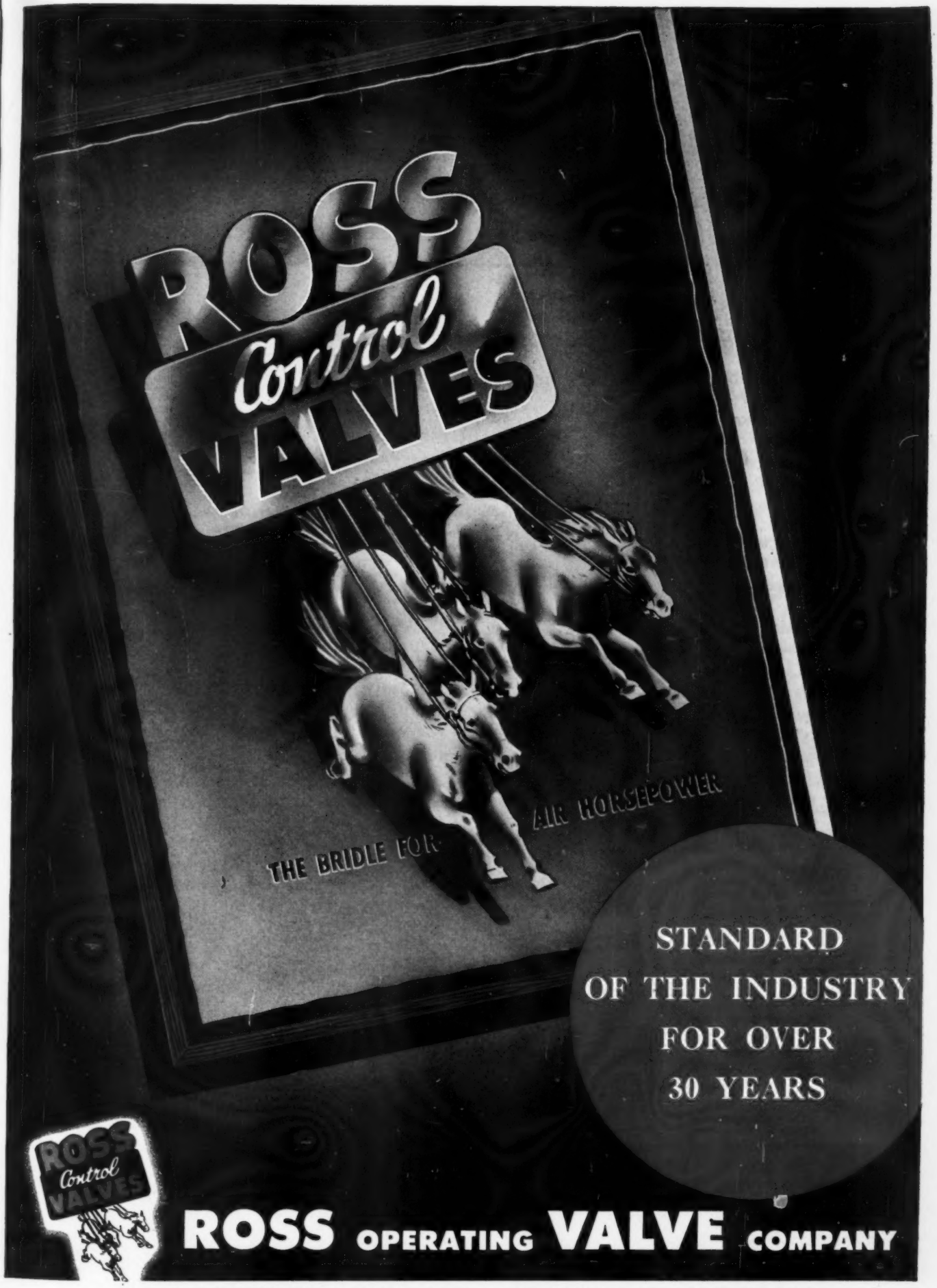

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FEBRUARY 1952
Vol. 5, No. 2

APPLIED HYDRAULICS

PNEUMATICS - HYDRAULICS - ELECTRICAL CONTROLS

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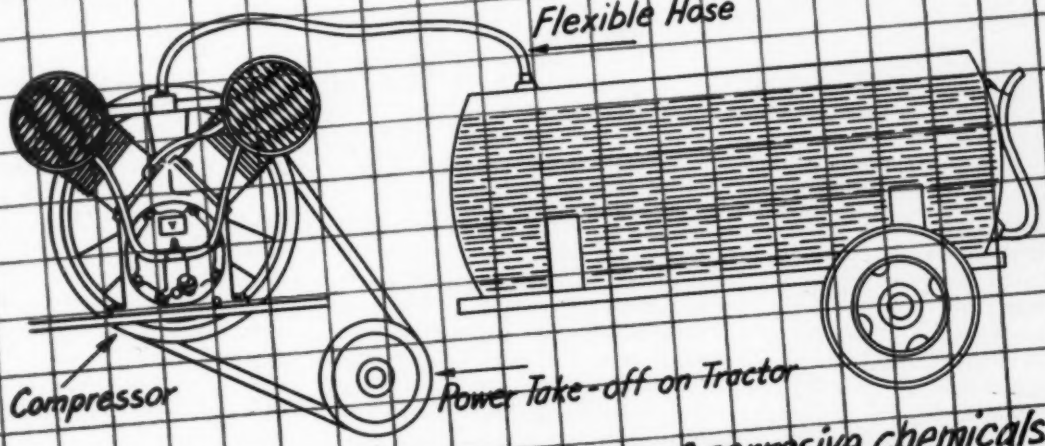
Ideas for Engineers

#8

Datair Sheet

EQUIPMENT: Chemical Tank Truck



APPLICATION: Displacement pumping of corrosive chemicals by forcing air into tank and building up pressure above liquid to force it through discharge hose.

SOLUTION: Westinghouse SYC Compressor mounted on trac for and driven from its Bower take-off.

RESULT: Pumping equipment removed from contact with corrosive chemical thus multiplying its life many fold.

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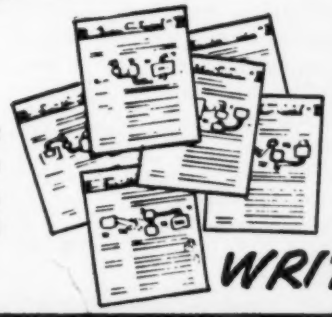

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Fluid Power Lines

Clean Oil . . . Oil companies, component manufacturers and machine tool builders all seem to be in agreement on what is the largest problem in keeping hydraulic machinery in operating shape. It's dirty oil. The careful circuit designer does everything possible to prevent damage or malfunctioning caused by moisture, dirt and air. But the big job of preventing break-down is up to the user. A. R. Morse, in the first part of a two part article on hydraulic maintenance describes means of keeping your oil system clean. It requires proper filters, oil containers and consistent schedule of care.

Design Records . . . During a visit to Detroit last fall, we called on Mr. H. E. Farmer who operates the H. E. Farmer Engineering Co. We were particularly impressed by the very complete design records which are kept by his staff. In Herbert A. Dyer's article on torque control, one of the calculation record sheets is reproduced. This sheet clearly shows the steps taken to determine a pump selection for a given job. Too often design calculations are only intelligible to the engineer who worked them out. Because of this, many costly design hours are lost when reference must be made to calculations which were completed months ago but are today illegible to anyone.

Years of Service . . . What's the expected life of hydraulic power drives? That's a question which we can't answer because it leads to more questions . . . such as . . . How many hours a day do you run the equipment? Do you have any maintenance set-up? Do you operate the drive within its designed limits? . . . and so on . . . The questions aren't any different from those asked about any other kind of equipment. However, since hydraulic production tooling and drives have not been around as many years as mechanical systems, there isn't always a drive, comparable to the one you plan to install, that has a long service record to help bolster your choice. One drive that has been operated under severe conditions since 1934 is described in this issue. Cost figures are given and from the experience of the Chicago Carton Company you'll get a good answer to . . . what's the expected life?

Delivery Problems . . . The initiative and enterprise of H. B. Mendelsohn and his son A. C., who operate a specialty furniture business, the Mendelsohn Mfg. Co., at Watertown, Mass., makes the story "How a Small Shop Selected Components for a Production Press", one of special interest to many small manufacturers that face tough problems on equipment deliveries.

Basic Pneumatic Series . . . The first installment of "A Beginner's Course in Basic Pneumatics" appears in this issue. This series will consist of approximately 30 installments. This and the March installment are introductory; they review available components and units and give a general picture of the range of pneumatic applications throughout industry.

New Applications . . . You've seen truck mounted concrete mixers moving down the highway with the mixing drum in rotation. Up until recently these machines used a mechanical drive. From the power requirement and maintenance standpoint this drive is a natural for a hydrostatic transmission. J. Foster Oury, president of The Imperial Ready-Mix Concrete Company in Melrose Park, Illinois, describes in this issue his company's development of a mixer drive. Their aim was improved quality of concrete and better service. The result was new use for oil power.

Coming . . . Are you considering developing your own production facilities for a part which has been made on the "outside"? Next month we'll take you on a picture tour of a new line at the Tappan Stove Company in Mansfield. You'll learn what factors were considered in deciding to make the part "at home", and how both air and oil powered equipment were adapted for the job. . . . There are many hydraulic applications in the northwest. Sawing logs is one of them. The job requires a rugged power source to feed the log through the saw. R. E. Davis describes the hydraulic system for developing high speed and fine control of this heavy load. . . . Also there will be articles on power systems for riveting, aluminum extrusion and swaging.

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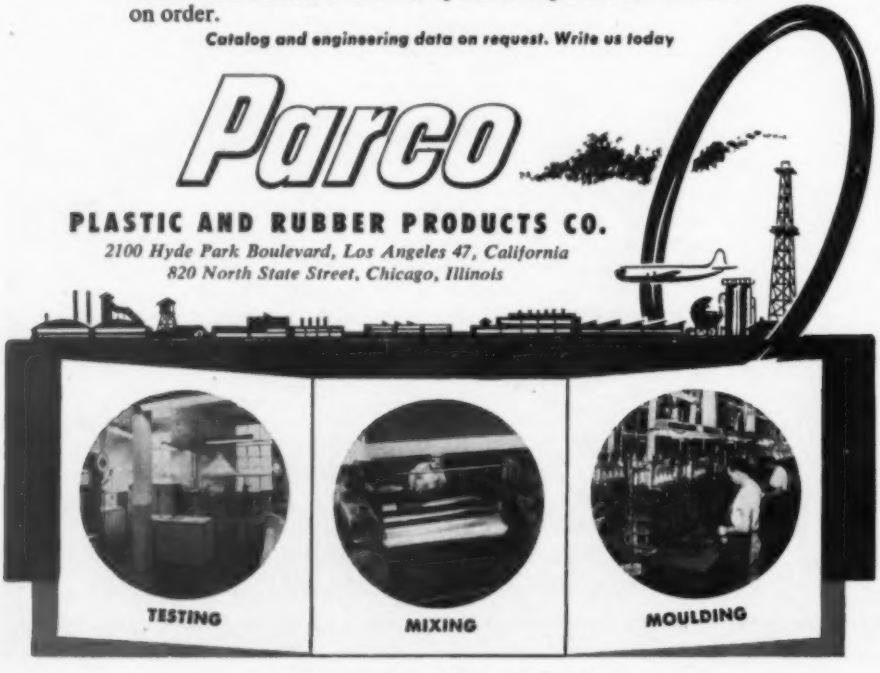


Circle 6 on Reader Service Card

LETTERS to the Editor

We would like to obtain the names of manufacturers of hydraulic presses or equipment that have operating cycles of 150 per minute or better in the 4 ton class. We know of the Denison line but would like to have other manufacturers of similar equipment in on our particular problem.

FRANK M. BAMBULA
Chief Engineer
The Scholl Mfg. Co., Inc.

Denison, as you know, makes one of the largest and most widely accepted line of presses in the class you indicate. Other manufacturers who offer presses approximately equivalent are Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.; Hannifin Corporation, 1155 S. Kilbourn Ave, Chicago, Ill.; Munton Mfg. Co., 9400 Belmont Ave., Franklin Park, Ill.; Colonial Broach Co., 21601 Hoover Road, Detroit, Mich.; La Point Machine Tool Co., Hudson, Mass.; Pines Engineering Co., Inc. 600 Walnut St., Aurora, Ill. and Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill. A much more complete list is to be found in the "Directory of Metalworking Machinery", 1951 Revision, published by the Munitions Board Cataloging Agency, Washington 25, D.C.

I want to take this opportunity to thank you for the very fine story written about our HOPTO Truck Crane that appeared in your November issue (pages 62, 109). This story was very well written. I would like to call your attention to an error in the last sentence of the first paragraph. The figure 15,000 pounds should be 1500 pounds.

ELMER V. MROZEK
Sales Manager
Badger Machine Co.

Thank you for calling this error to our attention. The figure refers to the load which a truck mounted hoist can lift and swing.

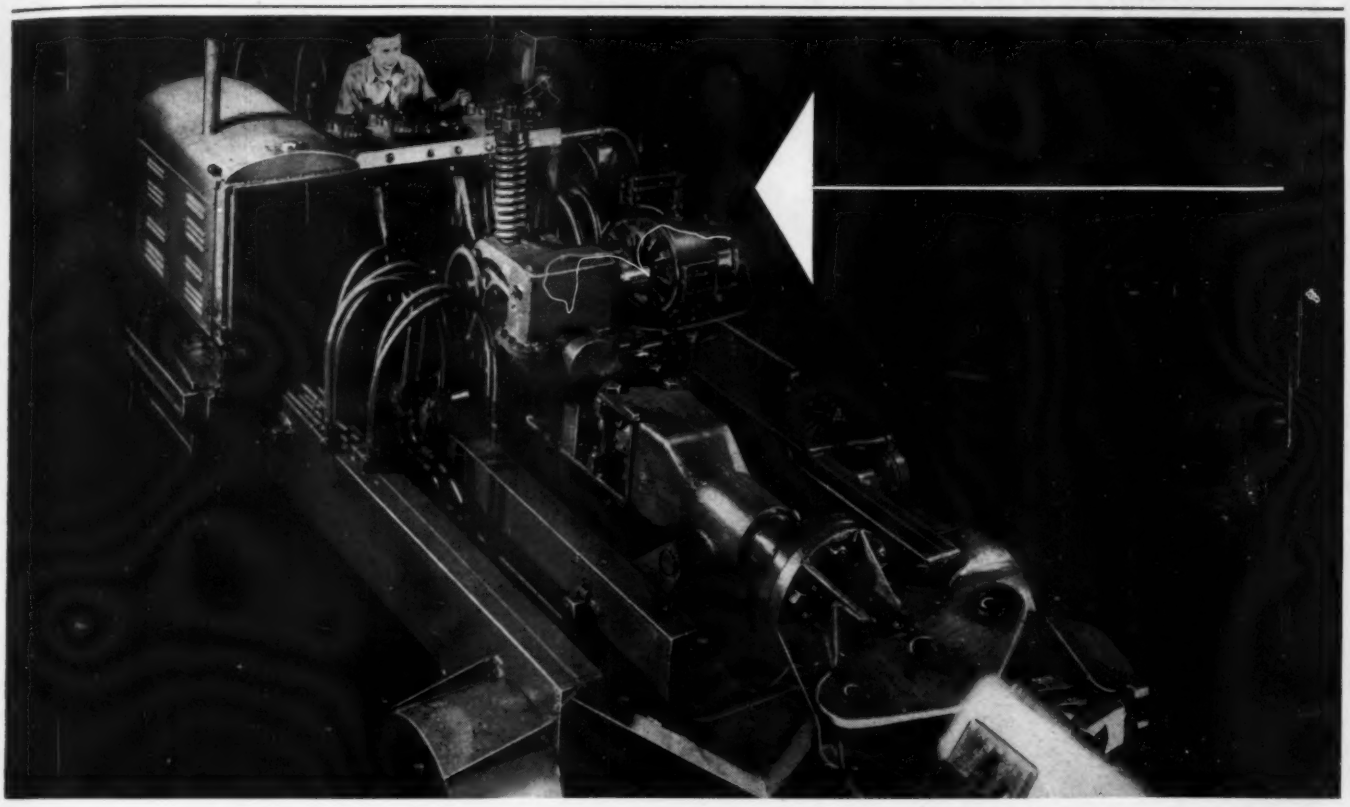
I would appreciate it if you will forward me a copy of "A Progress Report on Nonflammable Hydraulic Fluids" by Fred O. Hosterman.

WILLIAM PRINCE
Engineering Dept. 3506
The Glenn L. Martin Co.

A set of tear sheets on Mr. Hosterman's article has been forwarded to you.

Continued on page 8

WHEN IT'S HIGH PRESSURE IT'S AMERICAN!



Every operation of this modern mammoth is actuated by a

HELE-SHAW PUMP

BROSIUS AUTO-FLOOR MANIPULATORS serve hammers, hydraulic presses and heating furnaces in forging plants . . . and every working motion of these powerful machines is hydraulically actuated by a Hele-Shaw Pump. Brosius Division, Salem-Brosius, Inc., Pittsburgh, bought its first Hele-Shaw from American Engineering back in 1929, and it has been the standard specification ever since.

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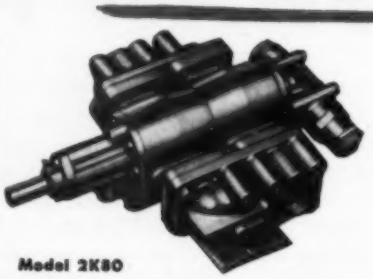
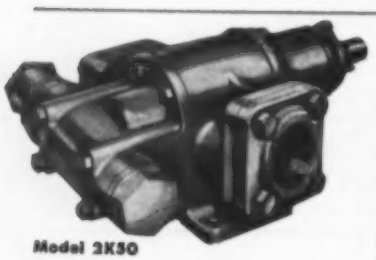

Model 2K80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Company.....

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Could you give us some idea about the availability of reprints of articles which appear in APPLIED HYDRAULICS? On one or two occasions we have received reprints and on several other occasions we were advised that no reprints were available.

K. N.

Reprints are made when the interest in a specific article is sufficient. There is no cut-and-dried rule for reprinting. Our practice is to hold editorial material for approximately 30 days after publication; after that period, forms are destroyed.

In the article "A Progress Report: Nonflammable Hydraulic Fluids" which appeared in the September issue of APPLIED HYDRAULICS there was a chart (top of page 68) of Temperature Versus Kinematic Viscosity for various types of hydraulic fluid. I am interested in obtaining a larger copy of this chart. Could you give me the name and address of the companies from which it could be obtained?

J. J. CIHI
Project Engineer
Simmonds Aerocessories, Inc.

The chart that you refer to in Mr. Hosterman's article is the ASTM Chart B: Saybolt Universal Viscosity, Abridged, a part of the series D 341-37T, ASTM Tentative Viscosity-Temperature Charts for Liquid Petroleum Products. Specifically this chart is American Tentative Standard A.S.A. No. Z11.39-1937-Chart B: Saybolt Universal Viscosity, Abridged. The chart measures 10 ½ x 7 ¾ inches and is available from American Society for Testing Materials, 240 South Broad St., Philadelphia, Pa.

I have read copies of APPLIED HYDRAULICS from time to time and would like to have copies regularly. What I am particularly interested in is more or less simplified hydraulic circuits that can be easily explained to the average layman. Now and then, I receive requests from engineers to detail and qualify a hydraulic circuit system so that they can apply it to their basic mechanical engineering.

C. G. FORSHEY
Forshey Engineering

We are placing your name on our list to receive APPLIED HYDRAULICS regularly; also we are adding your name to our 1952 Distributors List, now in process. The problem of applying a hydraulic circuit to various types of machines is a matter of experience and field training.

Continued on page 11

While basic hydraulic circuits do not vary very much for many types of industrial machines, there are refinements which may be peculiar to a given machine or drive, speed of operation or accuracy of cycle control. The use of JIC Symbols has both simplified and clarified hydraulic circuits. We regularly publish a considerable variety of circuits, all to JIC Symbols. Many readers regularly clip and file circuits which may be useful to them. Leading manufacturers of hydraulic components usually can furnish representative circuits or special diagrams to their dealers and distributors.

We read with interest the description of the Shallcross bleeder system and valve assembly for hydraulic automotive steering, as published in APPLIED HYDRAULICS, September 1951 issue, page 61. We are designing and building a road paving machine and we have considered using a full hydraulic steering system but, knowing the disadvantages that are a part of such a system, we have hesitated to take any positive action in the matter. We would appreciate the name and address of the manufacturer of the Shallcross system as described in the article.

H. E. SMITH
Engineering Department
Hetherington & Berner, Inc.

The manufacturer is Shallcross Controls, Inc., 2221 North 31st St., Milwaukee, Wisc. Mr. J. A. Morrow of this company will be able to give you the information you require regarding the application to your proposed equipment.

We wish to get what I think is called a "snubber" to go in between the pressure gauge and the line. If you don't have something of the sort, the gauge beats itself to pieces when the men throw the valves on and off. I understand this device has a check valve in it and a very small orifice so that when the valve is thrown the check valve bucks the flow which has to come out very slowly through the orifice. We would like to know the names of firms that make this device.

W. WALLACE MCKAIG,
MCKAIG'S

We believe that a unit which the Logansport Machine Company of Logansport, Ind. calls their "Gage Saver" (page 36 of their catalog No. 44) would fit the bill for a "snubber" such as you describe. Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill., Hannifin Corporation, 1155 S. Kilbourn Ave., Chicago 24, Ill., and Ross Operating Valve Company, 120 East Golden Gate Ave., Detroit 10, Mich. also offer similar units.

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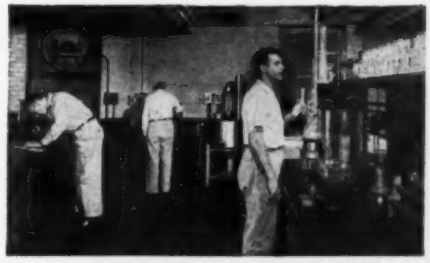

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10. Fine cushion adjustment.
11. Heavy wall precision honed hard chrome plate.
12. Controlled packing compression with metal to metal contact.

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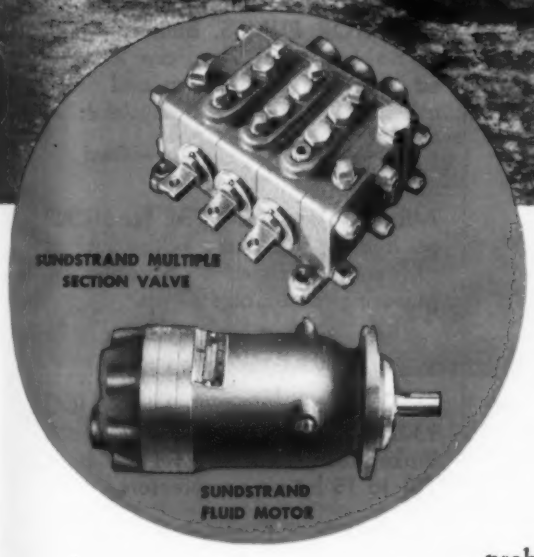

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Circle 24 on Reader Service Card

MASTER AND SLAVE SYSTEMS provide a simple means for positioning and controlling movement at a distance. Superdraulic Corporation has prepared a catalog on their units.

Circle 59 on Reader Service Card

POWER SAVING applications of bladder type accumulators are shown in Greer Bulletin 301. Data on proper selection and installation is included.

Circle 10 on Reader Service Card

MIDGET AIR CYLINDERS which will help you solve your tooling problems are illustrated in literature which is available from Air-Mite.

Circle 56 on Reader Service Card

OIL FILTERING data is supplied by Marvel Engineering Company in their folder 105. Installations of both line and sump type filters are described.

Circle 31 on Reader Service Card

ELEVATOR PUMPS, built by Geo. D. Roper Corporation, are illustrated in Bulletin 20. Design and operational features are emphasized.

Circle 8 on Reader Service Card

AIR POWER PACKAGE for 30,000 psi hydraulic pressure is the subject of literature offered by Sprague Engineering and Sales Corp.

Circle 76 on Reader Service Card

AIR COMPRESSORS Bulletin IDC 9302-2 issued by Westinghouse Air Brake Co. illustrates their "Y" type, 1 1/2 to 15 hp air compressors.

Circle 16 on Reader Service Card

HOSE FITTINGS Specifications on Clamp type, sleeve or sleeveless fittings for hydraulic hose circuits are available from Anchor Coupling Co., Inc.

Circle 17 on Reader Service Card

NEW SUPER-CUSHIONED air cylinders are described in Tomkins-Johnson Bulletin 252. Shock is prevented and fast action assured.

Circle 12 on Reader Service Card

COUPLING SELECTOR CHARTS are included in Lovejoy Flexible coupling Company's catalog.

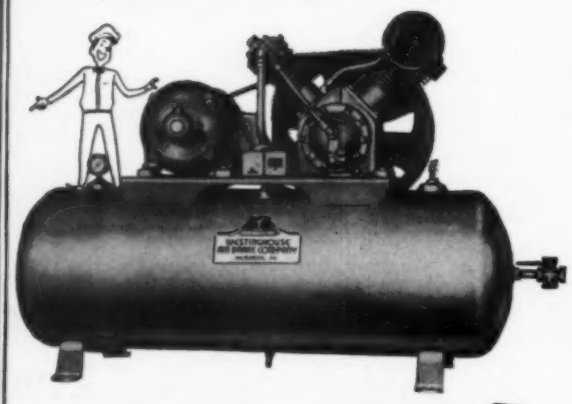
Circle 44 on Reader Service Card

Continued on page 20

NO OIL—

NO AIR!

that's why the Westinghouse "Y" saves money for you!



With most machines, *no oil* means a repair job. When someone forgets to lubricate, the oil-starved unit runs itself right into the repair shop.

With the Westinghouse "Y" Compressor, it's a different and happier story. The "Y" gives you warning when the oil level is too low; it refuses to pump air. If the level drops during operation, the "Y" unloads. This S.O.S. lets you supply oil before scoring, seizing or other damage occurs.

This exclusive "No Oil—No Air" protection has saved countless repair bills for users . . . and it's only one of a parade of modern features you get in the Westinghouse "Y". Thermal overload protection—Starting Unloader . . . automatic pressure control . . . automotive-type pressure lubrication . . . multiple V-belt drive. Every one helps to give you a more dependable, economical air supply. And that's a big consideration *today*—that no one can afford to overlook!

Only the Westinghouse "Y" gives you ALL THREE

Low Oil Level Protection—No Oil—No Air, bans wear and repair.

Thermal Overload Protection—Standard, at no extra cost, on the "Y".

Starting Unloader—Compressor remains unloaded till speed and oil flow are normal.

Westinghouse "Y" capacities range from 6.2 to 68 cfm displacements . . . motor HP from 1½ to 15. Gas engine drive also available. Horizontal or vertical tanks.

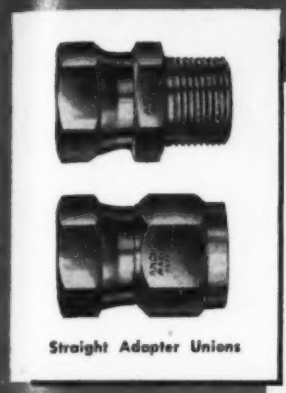
Westinghouse Air Brake Co.

Industrial Products Division—WILMERDING, PA.
Factory Branch: EMERYVILLE, CALIFORNIA

ASK FOR BULLETIN IDC 9302-3. FOR FULL DETAILS

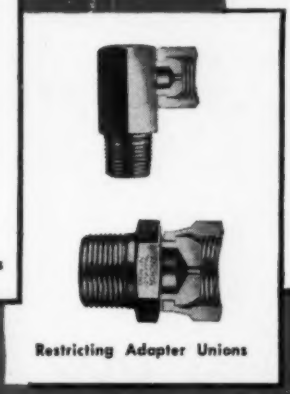
DISTRIBUTORS THROUGHOUT THE UNITED STATES . . . CONSULT YOUR CLASSIFIED DIRECTORY
DISTRIBUTOR IN CANADA: CANADIAN WESTINGHOUSE CO., LTD., HAMILTON, ONTARIO

Circle 16 on Reader Service Card

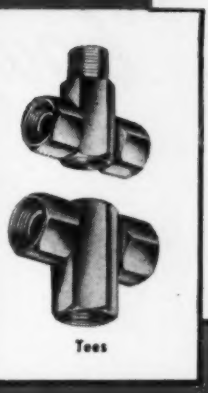


Straight Adapter Unions

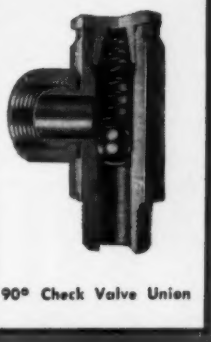
45° and 90° Adapter Unions



Restricting Adapter Unions



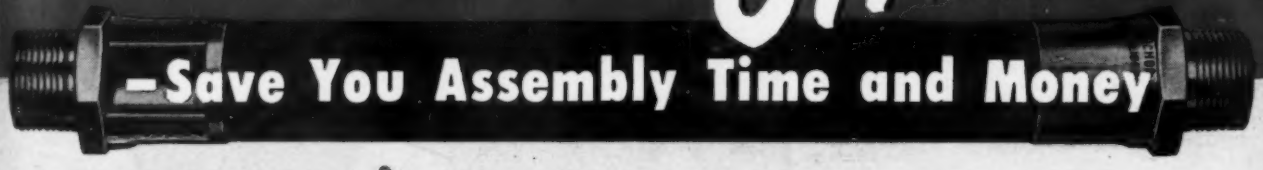
Tees



90° Check Valve Union

ANCHOR Adapter Unions

—Save You Assembly Time and Money



Anchor Ductile Sleeve Couplings assembled on two wire braid hose for high pressures.

Anchor Sleeveless Couplings assembled on either single wire braid hose or two rayon braid hose for medium or low pressures.

Anchor Clamp-type Couplings are ideal for field service use and emergency repairs. Easy to put on and take off—withstand high pressures.

Use Anchor Assembled Hose Units with the outstanding fittings shown above. You'll have less trouble in the shop on assembly — and less trouble in the field on the job.

Time is money. And whenever you save time, you reduce costs.

That's why it pays to use Anchor Adapter Unions and Related Fittings. You see, they're designed especially to speed the attachment of Anchor hydraulic hose assemblies to equipment of all kinds.

In addition to cutting assembly costs, Anchor Adapter Unions and Fittings have these important advantages:

- They provide a leakproof ground-joint connection.
- They are small in size, require little space, and provide a neat appearance.
- You can connect and disconnect them many times without destroying the seal.
- Made from solid steel bar stock and plated to prevent rust, they stand up under the toughest service conditions.
- Their use lets you eliminate one or more pipe-thread joints—gives you a better piping job.
- Assembly in confined spaces is quicker and easier.

The Anchor line of Adapter Unions and Related Fittings is the most complete line available. Save yourself time and money—select those that fill your specific needs.

Send for complete information on Anchor Adapter Unions and Fittings

CLIP COUPON TO LETTERHEAD AND MAIL TODAY!

ANCHOR COUPLING CO. INC.

Factory: Libertyville, Illinois • Branch: Detroit, Michigan

ANCHOR COUPLING CO. INC.
Dept. AH-22, Libertyville, Illinois

I like the dependability, the safety, and the time-and-money saving features of Anchor Adapter Unions and Fittings. Please send me a catalog.

Name..... Position.....

Company.....

Company Address.....

City..... (....) State.....

Circle 17 on Reader Service Card

Equipment Lasts Longer because

HYDRO-DRIVE

gives you . . . 5

VITAL INGREDIENTS IN ONE HYDRAULIC OIL!

HOUGHTON HYDRO-DRIVE is a scientifically fortified hydraulic oil that guarantees the long trouble-free performance you want more than ever today.

Hydro-Drive starts off as a high quality base petroleum oil. But modern equipment and high speed production need more than that. So Houghton "know-how" steps in to provide . . .

High film strength—just the right amount of chemical additive to assure long-lasting economical protection to hydraulic equipment;

Oxidation stability—through special treatment that serves to lengthen the life of the oil and safeguard machines;

Gum Solvency—by adding vital compounds that keep damaging gums from collecting throughout your equipment;

Rust inhibitor—another vital additive giving your precision-built equipment extra protection against costly rust damage due to moisture and humidity.

Hydro-Drive users are reporting double and better service life than they formerly got from straight-run oils. Try Hydro-Drive and prove these facts in your own plant. Write for bulletin and prices, to E. F. Houghton & Co., Phila. 33, Pa.

HYDRO-DRIVE

. . . a product of

E. F. HOUGHTON & CO.

PHILADELPHIA • CHICAGO • DETROIT • SAN FRANCISCO

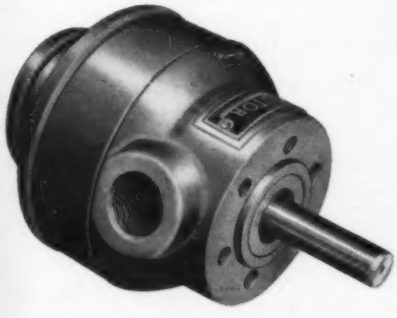
Ready to give you on-the-job service . . .

Circle 18 on Reader Service Card

headquarters HQ for HP hydraulic pumps

The unique Gerotor principle, found only in Gerotor pumps and fluid motors, increases the efficiency of any hydraulic circuit—in your plant or in your product.

Gerotor is headquarters for hydraulic pumps producing pressures up to 1000 p.s.i. continuous duty —in some sizes, up to 1200 p.s.i. continuous, 1500 intermittent.



GEROTOR

GEROTOR MAY CORP., P.O. Box 86, Baltimore 3, Maryland

Circle 19 on Reader Service Card

LITERATURE AND SERVICES OFFERED IN THIS MONTH'S ADS

Continued from page 16

DRAWING TEMPLATES for cylinders will simplify and speed your machine design layout. They're available from Ortman-Miller Machine Co.

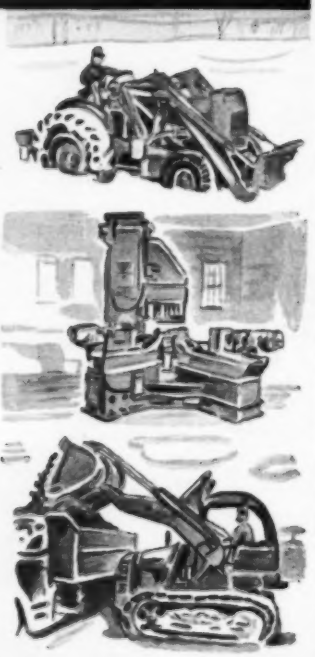
Circle 38 on Reader Service Card

DARCOVA PUMPCUPS Designed for reciprocating pumps and air and oil cylinders, these packings are described in Bulletins 4401 and 4502. Darling Valve and Manufacturing Co. has prepared these bulletins to show actual performance data.

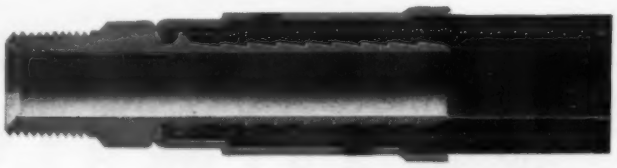
Circle 26 on Reader Service Card

MULCONROY *Hydraulic* HOSE ASSEMBLIES

With Triple-Grip "PRESS-LOCK" *Couplings*



With "Press-Lock" Couplings attached, Mulconroy Hose Assemblies provide a new measure of safety, efficiency and economy for all operating or control lines on every type of hydraulic equipment. They are available in three basic hose constructions, to meet any required working pressure; in a full range of sizes and in lengths up to 50 feet. Quickly and easily installed by attaching standard male threaded end of each "Press-Lock" Coupling.



Cut-away view showing unique construction of "Press-Lock" Coupling. Note that entire hose wall is employed.

Three-way gripping efficiency is provided by the "Press-Lock" Coupling, as follows: Inner section of hose wall is pressed into corrugations on stem; outer hose wall, with reinforcing wire, is displaced under pressure into openings in coupling sleeve; sleeve is anchored to collar on stem, back of hex portion.

Because the **entire hose structure** is employed in attaching the "Press-Lock"—no part cut away—hose will withstand shock loads and continuous flexing far beyond the limits attainable by use of conventional type couplings for this service.

Write for Illustrated Catalog

"MULCONROY *Starts...* WHERE OTHERS *Stop!*"

MULCONROY CO. *Hose Specialties Since 1887*

5329 JEFFERSON ST., PHILADELPHIA 31, PA.

Circle 20 on Reader Service Card

HAVE YOU CONSIDERED the unloading Gear-type gear pump for conventional variable volume pump applications? Specifications and performance charts are available on this new Pesco design.

Circle 58 on Reader Service Card

A TYPICAL MACHINE TOOL lubricating system is completely shown in Blueprint No. 114 prepared by C. A. Norgren Co.

Circle 45 on Reader Service Card

METALLIC PACKING for hydraulic cylinders is shown on specification sheets drawn by Hydraulic Accessories Co. Dimensional data on the packing and gland design are shown. . .

Circle 50 on Reader Service Card

AIR CYLINDERS, built by Lindberg Engineering Company, are detailed in Bulletin 731 giving the user information on sizes, pressures and mountings.

Circle 53 on Reader Service Card

IS WATER CAUSING DOWN-TIME? Honan-Crane offers an equipment bulletin describing their water-oil separator for hydraulic systems.

Circle 60 on Reader Service Card

AIR FILTERS having four multi-blade rotors which can handle from 7 to 17000 cfm are described in a catalog offered by Logan Engineering Co.

Circle 54 on Reader Service Card

HOW TO REMOVE PACKINGS is the subject of Durahook Bulletin DHAH prepared by Durametallic Corporation. Use of their flexible hand tools is illustrated.

Circle 71 on Reader Service Card

POWER IN A PACKAGE is obtained from Kobe heavy-duty 5000 psi reciprocating pumps. Kobe offers a bulletin describing these units.

Circle 65 on Reader Service Card

BULLETIN 651 gives details on the Nicholson air traps for pressures to 1500 psi.

Circle 42 on Reader Service Card

Continued on page 24

Meet Everett H. Clark

General Manager

International Packings Corporation

Affiliated with Graton & Knight Company

Educated at Worcester Polytechnic Institute, Mr. Clark met his first packings problems as a designer and manufacturer of precision instruments. With Graton & Knight Company since 1935, he has been factory worker, foreman, sales correspondent, sales engineer, sales manager and finally General Manager of the Packings Division. He wrote the 320-page Graton & Knight Packings Manual, which has been adopted as a text book in many of the technical schools and colleges. A member of the Standards Committee of the American Leather Belting Association, he is now at work on the standardization and simplification of packings through the Joint Industry Conference.

In this current series of advertisements we want you to meet these men. Their experience is yours to command.

There's a personal side to every packings problem

It lies beyond the Dash number, with its dimensions. It involves questions relating to fluid: its pressure and temperature range; to apparatus: its function, metals and finishes . . .

At G&K-INTERNATIONAL your answers to these questions receive the personal attention of men who have lived and worked with packings applications for many years. Their experience in leather and impregnants, in basic rubbers and compounds, in design and manufacture . . . all are summed up for you in packings that meet *your* needs exactly.

second century G and K — INTERNATIONAL

GRATON AND KNIGHT ESTAB. 1851

Leather and synthetic packings

GRATON & KNIGHT COMPANY
Worcester 4, Mass.

INTERNATIONAL PACKINGS CORPORATION
Bristol, New Hampshire

Circle 23 on Reader Service Card

← Circle 22 on Reader Service Card

Type VEU-GH Upright

U.S. VARIDRIVE

DEVELOPS *EXTRA* MACHINE OUTPUT YOU NEVER DREAMED POSSIBLE

Automobiles go modern with automatic transmissions. Production machines go modern with U. S. Varidrive—*the miracle motor.* It changes to any selected speed *instantly.* The Varidrive can run in unison with the rhythm of the operator. It will increase your workers' abilities and quality of product. It can be run slow or fast or at any in-between speed, right to a split rpm. Machines that "loaf on the job" can be stepped up to unlock their surplus capacity. You don't have to change gears, shift belts or use a rheostat. Just turn a control dial. The U. S. Varidrive Motor is self-contained, all on one base, embodying a motor with a built-in speed control. By increasing machine output, the Varidrive repays its cost within a few weeks or months. *Install Varidrives* for greater profit.

Type VE Horizontal Varidrive

YOU GET THESE *Extra* ADVANTAGES

- *MORE OUTPUT EVERY HOUR*
- *LESS LABOR COST PER UNIT*
- *ELIMINATE GEAR BOXES*
- *COMPACT, ENCLOSED, STREAMLINED*
- *DIRECT CONNECTION TO MACHINE*
- *10 TO 1 SPEED RATIOS*
- *SHOCKLESS TRANSMISSION*
- *SMOOTH, QUIET OPERATION*
- *SIMPLEST DIAL CONTROL*
- *WEATHERPROOF HOUSING*

U. S. VARIDRIVE MOTOR

2 to 10,000 RPM

U.S. ELECTRICAL MOTORS Inc.
(Box 2058) Los Angeles 54, Calif., or Milford, Conn.

Get This Profit-Revealing Bulletin

Describes U.S. Varidrives, with interesting color illustrations of various types and sizes from ⅓ to 50 h.p. Tells how you can cut production costs.

REQUEST FOR U. S. VARIDRIVE MOTORS BULLETIN

U. S. Electrical Motors Inc. AH-2
(Box 2058) Los Angeles 54, Calif., or Milford, Conn.

Name_____

Company_____

Address_____

City_____ Zone_____ State_____

Circle 24 on Reader Service Card

Literature Offered in This Month's Ads

Continued from page 20

BULLETIN 510 prepared by Ledeen Mfg. Co. describes their air and hydraulic valves made in 14 different models for 5 different cycles, in 6 sizes.

Circle 39 on Reader Service Card

QUICK CONNECT COUPLINGS for pneumatic service are detailed in literature prepared by The Hansen Manufacturing Company.

Circle 25 on Reader Service Card

RECOMMENDATIONS for applying oil filters are described in literature available from The Hilliard Corporation.

Circle 69 on Reader Service Card

"O" RING ENGINEERING DATA is offered by the Plastic and Rubber Products Co.

Circle 6 on Reader Service Card

THE GEROTOR principle of gear pump operation for pressures to 1200 psi is discussed in an available catalog. Complete specs are given.

Circle 19 on Reader Service Card

LEATHER PACKINGS Want to know more about Rhoads Tannate to meet your exact packing requirements? Write to J. E. Rhoads & Sons for details.

Circle 57 on Reader Service Card

CYLINDERS with new cartridge type packing gland are shown in engineering data sheets available from Petch Manufacturing Company.

Circle 61 on Reader Service Card

COMPACT BRONZE FLUID HANDLING PUMPS giving large deliveries where space is at a premium are detailed in literature offered by Oberdorfer Foundries, Inc., Industrial Pump Division.

Circle 48 on Reader Service Card

Instant Automatic Flow and Shut-Off

Quick Connection and Disconnection

WHY *Genuine* HANSEN COUPLINGS GIVE BETTER SERVICE LAST LONGER

LEAK-PROOF, Minimum Wear Locking Device

Integral Factory-Assembled Tamper-Proof Socket Head

PICK GENUINE HANSEN COUPLINGS FOR HANSEN PERFORMANCE...

Locking pins in Hansen Push-Tite Coupling Socket afford large area contact with plug, thereby preventing wear and subsequent leakage.

● The ability of Hansen Push-Tite Couplings to withstand severe service — with practically no maintenance — has been thoroughly proved by years of hard everyday use in thousands of plants. The "socket head", which contains the locking device, is factory assembled into a rugged integral unit which cannot be readily injured or have component parts lost by casual tampering.

To connect the coupling, you merely push the plug into the socket with one hand. Flow is instantaneous. To disconnect, push back sleeve on socket — coupling disconnects. Flow is shut off instantly and automatically.

Write for catalog giving complete range of types and sizes.

QUICK CONNECTIVE FLUID LINE COUPLINGS *for*
AIR • OIL • GREASE • HYDRAULIC FLUIDS
WATER • VACUUM • STEAM • OXYGEN • ACETYLENE
REFRIGERANTS • GASOLINE • COOLANTS

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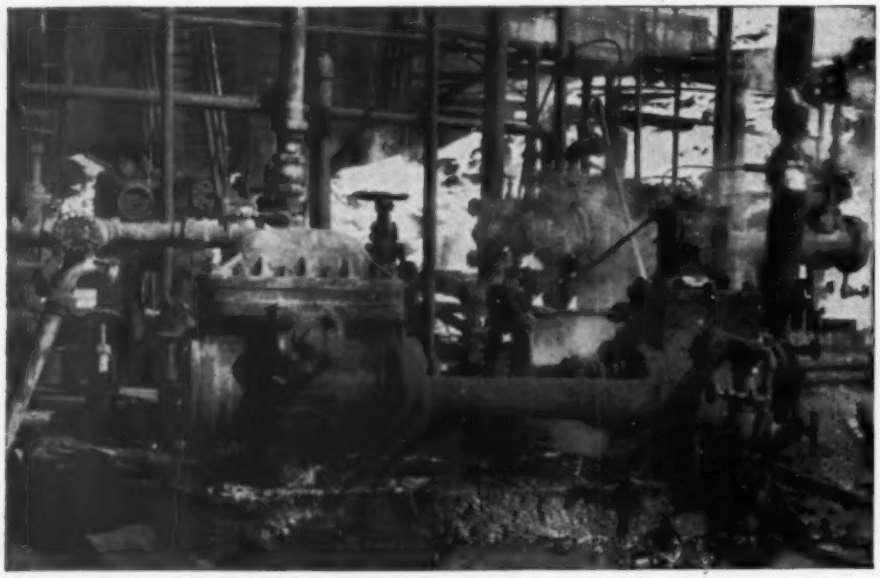


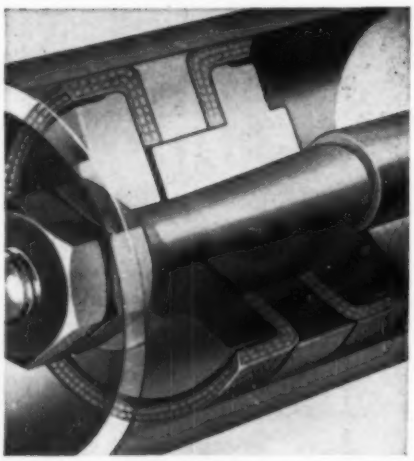
"CHAMBER OF HORRORS"

—for anything but a DARCOVA PUMCUP!

"HOW tough can life get", says ordinary packing inside this pump. Yet, year after year this pump is required to handle acid treated oil products from the base of a heated still to the next purifying process.

Ordinary packing would soon allow slippage to occur—but not Darcova Pumcups. Pumcups retain their efficiency even when severely worn. This installation has operated efficiently for over eight years.

No matter how tough your pumping problem may be, you can do it more efficiently and for lower cost with Darcova Pumcups!



Cross section showing Pumcup installed.

Write for free bulletin No. 4401 on how Pumcups can help solve your pumping problems!

DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT 15, PA.

DARCOVA
THE ORIGINAL COMPOSITION CUP
PUMCUPS

Circle 26 on Reader Service Card

Symposium of High Pressures

Plans are rapidly developing for a High Pressure Symposium to be held at the annual meeting of the Industrial Instruments and Regulators Division of the American Society of Mechanical Engineers in Cleveland next September.

While high pressure work in instruments will be stressed, a well-rounded program will cover all fields of interest relating to current operations in the pressure range from 10,000 to 150,000 psi.

The Division is asking for papers on the design of instruments for measuring pressures and for measuring the physical properties of materials in this range. Also to be included are papers on the design of apparatus and plumbing used to develop, transmit and contain these pressures.

The tentative program includes papers in the following groups:

1. Survey and historical
2. Measurements
3. Properties of materials
4. Pressure vessels
5. Pumps and plumbing

W. H. Howe, chief engineer, The Foxboro Company, will be in general charge of arrangements for the Symposium.

Engineers are requested to submit an abstract of their proposed papers to Mr. Howe as early as possible. Deadline for completed manuscripts is May 1, 1952.

NCIH Sets September Dates in 1952

The National Conference on Industrial Hydraulics will hold their eighth annual meeting during the Centennial of Engineering, which will be held September 3-12 in Chicago. The exact dates have not been announced but planning for the Conference is already actively underway. With the great number of engineers, including foreign visitors, expected in Chicago for the Centennial of Engineering meetings, plans are being made for the largest and most comprehensive program yet undertaken by NCIH.

Pressure Switch Controlled Booster Circuit For Production Testing

By D. A. Kuhna and W. W. Hutcherson

Fig. 1. A brake light switch is being loaded into a clamp fixture. Gages on the rear panel will record the hydraulic high pressure breakdown test and low pressure contact test. The knobs above the gages control the input air pressure to the booster units.

"If we examine our existing processes and find that we have not changed our methods in fifteen to twenty years, because of rapid technological advances, we automatically find ourselves in a back-seat position—someone else has found a better way."—Charles F. Kettering

EVERY process engineer is continually looking for new ways of doing old jobs more cheaply. He is always designing equipment to be built as much as possible from standard manufactured items, thereby lowering overall costs through the obvious advantages of high production per item.

Here, we want to tell you how a few alert minds were applied to a given process testing problem and came up with a solution that improved the production rate, gave an accurate test, and reduced operator fatigue. One operator was saved by combining two phases of the test automatically within the unit and, except for the clamp fixture which had to be designed for the specific part, all electrical, hydraulic and pneumatic equipment specified were standard units.

D. A. Kuhna and **W. W. Hutcherson** are engineers with J. N. Fauver Co. Inc., Detroit, Mich.

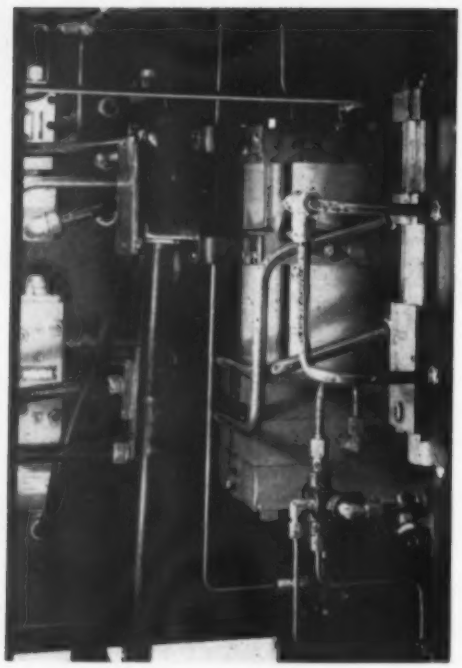


Fig. 2. The power system built in the base of the machine includes the high and low pressure boosters shown here. On the back wall to the left are the 2 position, four-way solenoid operated air valves which direct oil to the boosters.

One of the major automotive manufacturers produces a brake light switch which is essentially a pressure switch actuated from the foot brake master cylinder of the vehicle causing the rear brake light to light. Their manufacturing standards specify four major items of test around which the test unit was built.

1. 2500 psi hydraulic pressure to be applied to the tested switch as a pressure breakdown test and also to assure seating of the metallic pressure diaphragm.
2. 130 psi hydraulic pressure to be applied to determine that the switching element makes contact between 60 psi and 110 psi.
3. That the switch element, during the contact time in test, carry the same amperage as two brake light bulbs on a 6 volt battery circuit.
4. That we produce 10 parts per minute through the test unit.

To meet these requirements, the machine shown in Figure 1 was designed using an air-hydraulic circuit seen in Figure 3. Five pressure switches are used to sequence the automatic operation. One of these switches is a commercial diaphragm type unit. Three are Bourdon tube type, while the fifth is a Bourdon tube pressure gage (0-5000 psi) having electrical contacts.

Two ram-piston type air-hydraulic boosters are used. The larger booster will develop 2500 psi oil pressure from an 80 psi shop air line. The smaller booster provides 160 psi oil pressure at 80 psi air.

When the machine has been set for automatic cycling, the operator has only to load and unload the machine. After loading the brake light switch into the fixture, he presses two mushroom buttons to energize the clamp solenoid valve 6 applying air pressure to the clamp cylinder.

The operator presses the cycle start switch to energize solenoid of valve 7 starting the high pressure test. However, valve 7 will not operate unless pressure switch 1, in the clamp circuit, has closed assuring that the part is tightly clamped before high pressure is applied. When the 2500 psi pressure setting of PS-2 is reached this switch closes to deenergize valve 7 and release the high pressure. Closing of switch 3, on falling pressure, closes electrical relay contacts in the low pressure circuit, energizing valve 8. The low pressure test will start when pressure from the large booster has been relieved.

The two pressure switches in the low pressure circuit

Concluded on page 62

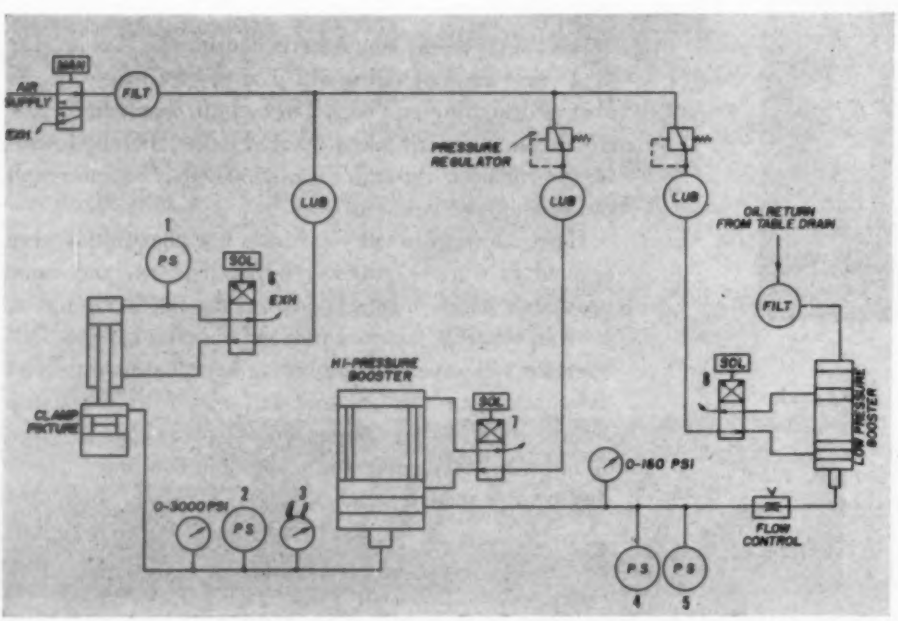
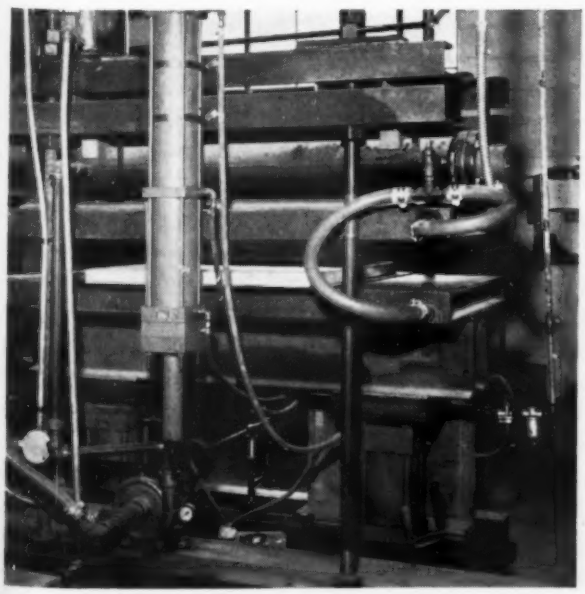


Fig. 3. The air hydraulic circuit used on the brake light switch production test machine uses five pressure switches to control the sequence of operation.

How a Small Shop Selected Components For a Special Production Press

Fig. 1. Front view of hot platen press for making plastic top surfaces on specialty furniture. The work cylinders, control valves and gauges are shown.

Fig. 2. The booster is mounted on the rear of the press. Water pump and platen hose connections are shown. The heater control is on the right end of the press.



Last spring, when the Mendelsohn Mfg. Company decided to exhibit plastic top specialty furniture in the National Show, they had to design and build their own press to do it. How this was done is a very interesting combination of ingenuity, enterprise and fortunate circumstances.

LATE LAST WINTER, HARRY B. MENDELSOHN, HEAD of the Mendelsohn Manufacturing Co. of Watertown, Mass., decided to show some new designs with plastic tops at the June Furniture Show. He could build the pieces, secure the photolith, impregnated backing and clear cover sheets to make up the tops. All he lacked was a hot platen press. He refused to be discouraged at the head-shaking attitude of the representatives of press manufacturers. With the approximate specifications of the press he needed in hand and with his son, A.C., a graduate of a leading technical school, supervising, he decided to build his own press.

They went to work immediately. They had 60 days before the show was to open. By using structural steel for the frame members and the platens and standard I beams for the bolster plates, they made a start. They were able to find an electric platen heater of the right capacity and size to fit between the channels to which the face plates of the platens were welded. Water was used at the heat transfer medium, and an easily secured centrifugal water pump was used to circulate hot water through the platens. They had 120 psi shop air.

The big hitch was to find a means of closing the press and holding it closed under pressure for the necessary curing cycles of approximately 7 minutes.

Two general methods were considered. A straight hydraulic system or the use of a high ratio booster

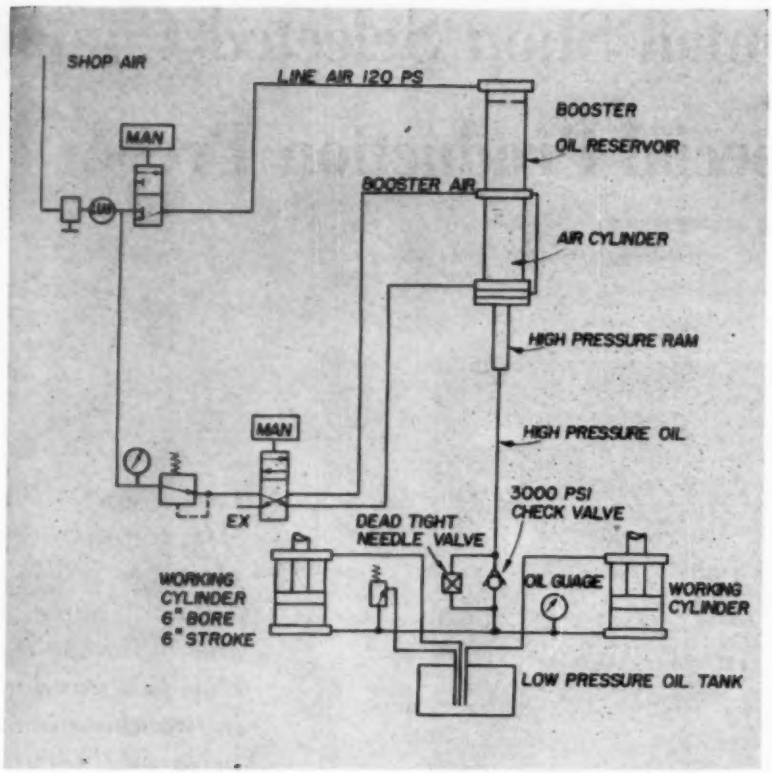


Fig. 3. Schematic of the air-hydraulic circuit.

that would utilize shop air would do the job. A straight hydraulic system would require a high pressure pump, cylinders, operating valves and a timing system. A somewhat simpler setup using a booster would not only utilize shop air but several air valves on hand. However, quoted deliveries on both the hydraulic system and the booster setup were far beyond the 60 day deadline they wanted to meet.

Decide on Booster Circuit

They canvassed and listened to their regular equipment suppliers and checked every source they knew that might be able to furnish the essential components. In the meantime, the press was put together and the heating unit installed.

One of the regular suppliers in close touch with the Mendelsohn's problem was Harold Hemming of Gibson Engineering Co. of Boston. Because the Mendelsohns were doing most of the construction themselves and the booster arrangement was somewhat simpler, effort was concentrated on securing the hydraulic cylinders and the booster rather than the pump and other components required for the straight hydraulic system. Fully appreciating the formidable time obstacle, Hemming made a special request to his principal, a manufacturer of cylinders and boosters.

Without interrupting regularly scheduled deliveries, the manufacturer was able to earmark the two working hydraulic cylinders and a 25 to 1 air-hydraulic booster.

The units were shipped and promptly installed. The valving and gauges were connected and the press tested and adjusted. Since the adjustment of pressure was made by the reducing valve and the air four-way valve, the correct or optimum working pressure for a specific part area was easily and quickly determined.

The critical sample table tops were completed with time to spare. In fact the building time was actually only six weeks!

The main frame of the press and the platen plates are structural steel; the press is welded throughout. Platen size, nominally 30 x 60 inches, is actually 31 x 62 inches. Four tie-rods on 40 inch front centers, permit practically all the range of sizes made by Mendelsohn to be inserted and removed from the front of the press. Longer pieces can be inserted from one end of the press which is entirely free of obstructions. The lower platen is raised to close and lowered to open the press by means of two 6 inch bore, 6 inch stroke hydraulic cylinders. Closing speed is 10 seconds; opening speed is 15 seconds by gravity only. The upper platen may be raised and lowered manually to give any desired opening within practical limits.

The press is designed to deliver 81 tons at 2900 psi oil pressure. Branches from a common supply line actuate the closing movement, insuring that the cylinders move together and exert the same pres-

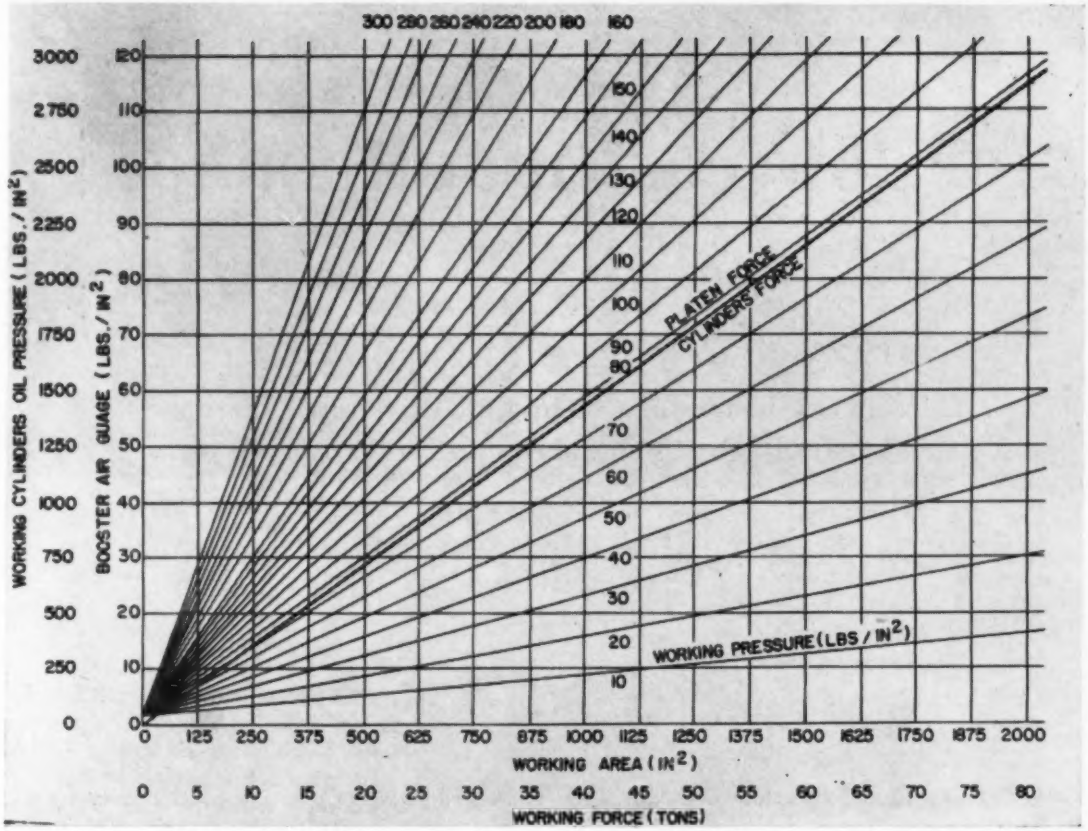


Fig. 4. A work pressure chart made up specially for the hot platen press. Having a desired working force or pressure for a given working area the booster air pressure setting is quickly read from the chart.

sure. High pressure oil is supplied by the standard 25 to 1 air-hydraulic booster mounted vertically on the rear side of the press above the platen area.

Cycle of Operation

The cycle of operation is very simple. (Figure 3, circuit diagram). Control is by lever operated valves on the front side of the press. A three-way valve mounted just behind the filter unit in the shop air supply line admits air to the top end of the booster. A four-way air valve connected to a line between the filter and the three-way valve admits and returns air to the air cylinder in the booster. A reducing valve and gauge just before the four-way valve controls the pressure of the air admitted. A check valve and by-pass in the hydraulic line permits more than one high pressure stroke of the booster. This added flexibility to the press cycle gives accurate adjustment for various surface areas of pieces and the curing time.

Because the working pressure is manually controlled, it was necessary to have a convenient means of determining the optimum working pressure for the range of surface areas to be hot pressed. This was done by constructing a work pressure chart, Figure 4, on which the anticipated range of work areas, the working pressures in psi and the relation of booster air pressure to working cylinder oil pressure are plotted graphically.

Granted that the finished press is not a thing of beauty. It does the job for which it was designed and built, and it does it economically and efficiently. The elder Mendelsohn estimates that charging a double rate for both his and his son's time for the actual number of hours spent on design, consultation, construction and adjustment against the press, would still give them a press for approximately half the cost of an equivalent standard press, if they had been able to buy one.

There are a good many tough problems involved in designing and building a special purpose press. However, with fundamentally sound design, use of standard structural members, standard power and control units, the Mendelsohns proved that such a press can be built and operated successfully in the average shop. With only 60 days to design, secure parts and components, install, test and operate their hot platen press, the Mendelsohns proved that ingenuity, knowledge of fundamentals, plus some favorable deliveries, paid off handsomely.

"for low cost maintenance . . ."

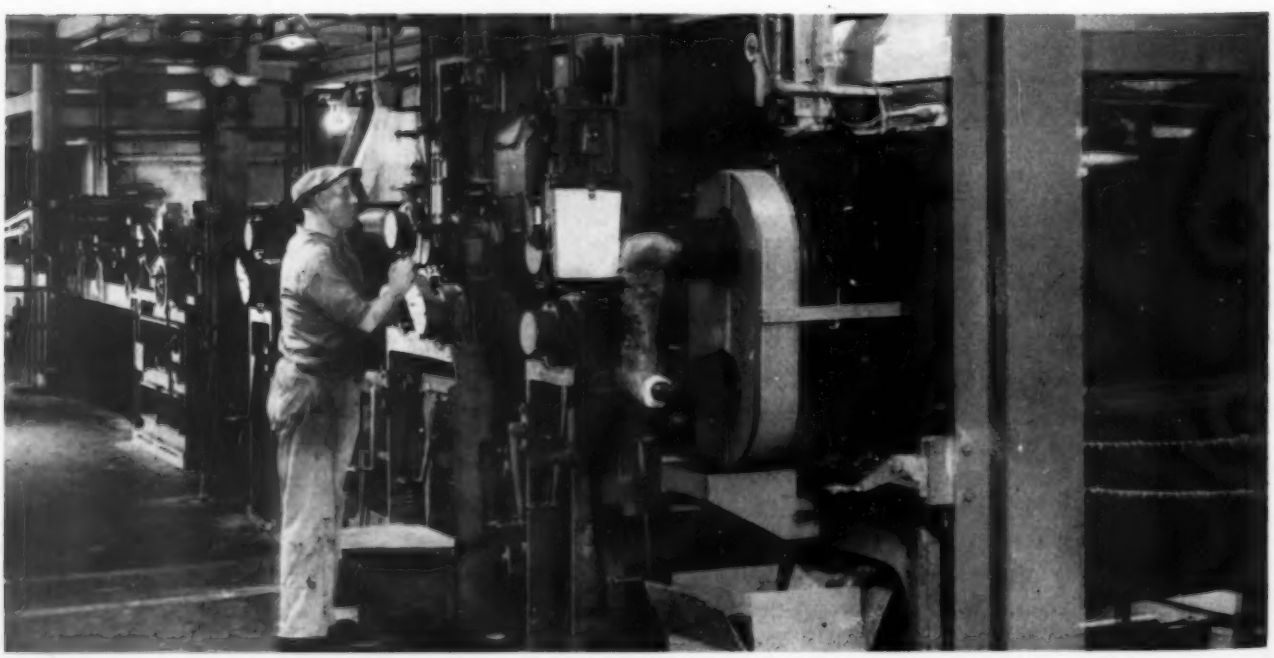
Here's a case history of a 40 hp fluid drive which has operated 16 hours a day in humid conditions for over 16 years.

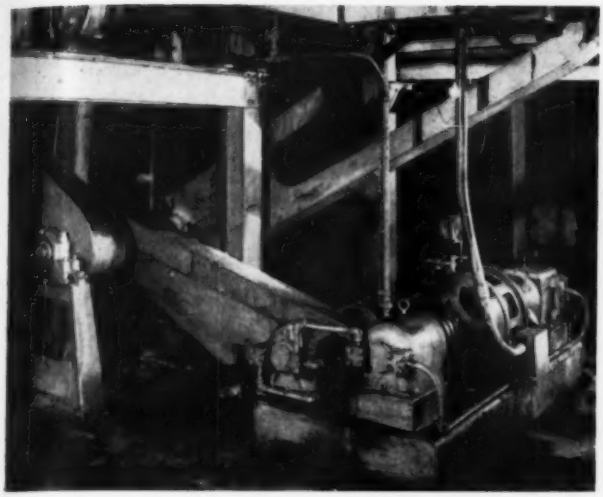
BACK in 1934, the Chicago Carton Company installed a 40 hp combining machine drive and a 7½ hp synchronized cut-off drive. Hydraulic equipment for both drives, as shown in the photographs and circuit drawing, required an original investment of $4431. Today, after more than 16 years of service, maintenance records indicate a total expenditure of $93.21 for service and parts, an average of less than $6.00 per year.

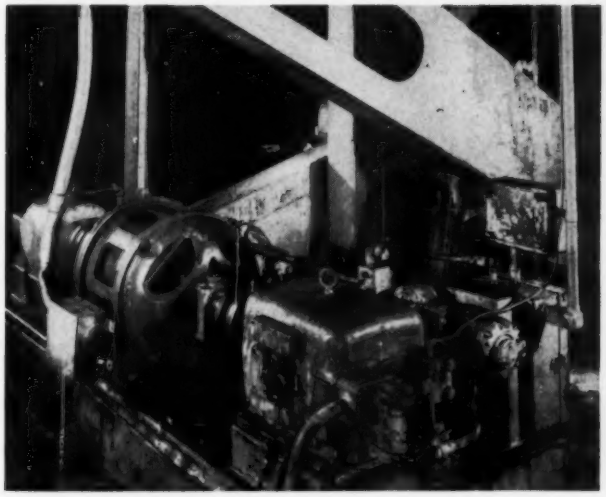
The hydraulic drive system has been subjected to rugged service, operating continuously 16 hours a day in a necessarily humid atmosphere.

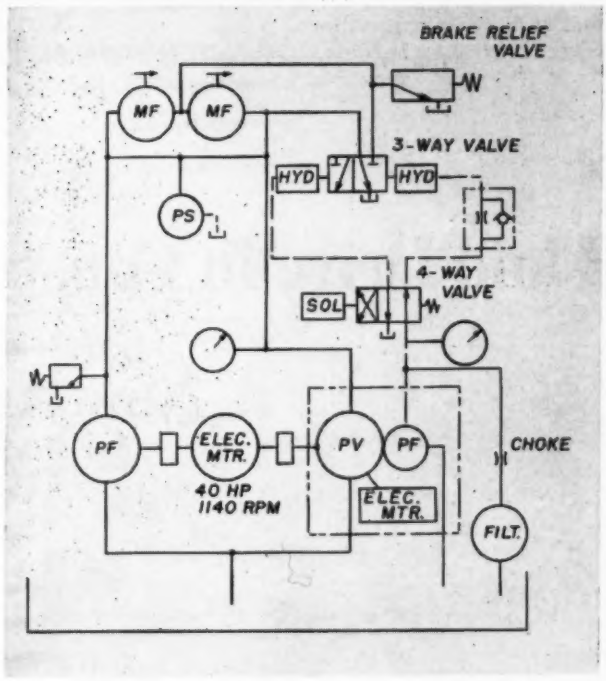
Various weights of board are coated, sized and laminated on this machine. Silicote or water glass, wax and asphalt are some of the materials that are used in coating and laminating. The finished sheets range in size from 18x25 inches to 45x70 inches and are used for cracker boxes, cookie cartons, ice cream cartons, etc. The machine, similar to a printing press, has a continuous web of material passing between a number of sets of rollers.

A side elevation view of the complete combining paper machine drive. The machine consists of two units; a main laminating drive and a cut-off drive.









Two views of the main drive on the Chicago Carton combining paper machine. The variable delivery pump having electric remote control is mounted on the left end of the oil reservoir. On the right end is a constant delivery radial piston pump. Both pumps are directly connected to the double ended 40 hp electric motor.

Seen directly in front of the constant delivery pump are the two fluid motors providing the main machine drive.

The schematic circuit at the left shows the main drive hydraulic components.

The web makes one long trip out and back over an isolated roller to dry.

Fluid power has provided efficient, rugged operation with easily controlled variable speeds to best fit the type of board being processed. The cut-off drive follows in synchronism to cut stock into uniform lengths.

Oil power for the 40 hp combining machine drive is supplied by two pumps. A variable delivery radial piston pump having an electric pilot motor control to change pump delivery, and a constant delivery pump are directly connected to a double ended 40 hp electric motor. The jackshaft of the machine is driven by two constant displacement fluid motors which are connected in parallel to the oil from the two pumps. Each motor can transmit up to 20 hp continuously or 25 hp intermittently at 850 rpm.

By means of the electric remote pushbutton control, the jackshaft speed is variable up to 850 rpm with the speed range from 120 rpm to 850 rpm made in 45 seconds. The hydraulic system provides smooth, high speed acceleration and fast start-stop control. An adjustable hydraulic brake exerting any braking force desired between 5 and 40 hp is operated from an overload pressure switch, or limit switches which guard against overrunning, or pushbutton stations. Any of these electric controls will deenergize the solenoid of the 2 position, 4-way valve seen in the main drive circuit. The valve shifts to direct pilot oil to move the 2 position, 3-way valve to the position shown in the schematic. Pressure oil from the pumps is dumped to tank through the 3-way valve as shown. The motor return port is blocked. At this time the inertia of the motors causes them to act as pumps, but oil discharged against the spring load of the brake relief valve acts to brake motor rotation. Pilot pressure

Concluded on page 63

Here is the step-by-step development of a hydraulic drive system for a concrete transit mixer. A concrete producer aiming toward improvement of his product and service, found that he had to design his own mixer. He tried the conventional mechanical drive, then went to a dynamic fluid drive and then worked out his final design using a compact hydrostatic transmission. Having this new fleet of mixers in operation, this producer found he had a new product to market—The Hydrocreter.

Fluid Drive in Construction Equipment: A New Application of Oil Power

By J. Foster Oury

DEVELOPMENT of the Hydrocreter* an all hydraulic transit mixer, resulted from Imperial Ready-Mix Concrete Company's program of quality control. Being in the ready mix concrete business, our primary concern is to supply a product of high quality which is fully controlled. We have always felt that best results are obtained by using agitators in the delivery of the concrete.

Building an entirely new drum drive was not our first objective. Concrete is our product and our first step was to purchase commercially available truck mixers and adapt them to our needs. We wanted a mixer which would be free of excess gear and would provide for carrying and agitating a maximum payload.

We found that the first 10 truck mixers using a me-

J. Foster Oury is president of Imperial Ready-Mix Concrete Company, Melrose Park, Ill.

chanical power system were satisfactory from a general operational standpoint, but maintenance costs were extremely high. The mixer transmission on these trucks was connected to the power take-off by a chain and sprocket design which required operation at high speed and heavy starting torques resulting in frequent breakdown.

Although the working load horsepower requirements of transit mixers are relatively low, the power take-off assembly must absorb a high initial starting torque. On an agitator carrying 4 cu yd of concrete, the starting torque must be great enough to break loose a load of 16,000 pounds. Using a mechanical drive considerable strain on the power take-off shaft has resulted.

Having carefully studied the operation of this mechanical equipment and recording all the maintenance problems, we set about to design a drive that would:

1. Eliminate starting torque on power take-off
2. Increase payload by reduced drive weight
3. Reduce maintenance costs.

Our first experimental model used a fluid drive coupling from the power take-off through a helical gear reduction unit. The fluid coupling solved the starting torque problem however, it was found that the drive was not rugged enough to handle stiff mixes and dry batching. To "beef up" the drive would have resulted in increased weight defeating one of our prime objectives—increased payload.

Compact, Efficient Drive

The final design, as shown in the accompanying circuit and photo uses a commercial rotary vane pump and motor combination which is extremely compact and only weighs 130 pounds. The motor has a torque of 3300 in-lb from a dead standstill; it can produce 14 hp at 250 rpm. Efficiency of power transmission was better than 80 percent.

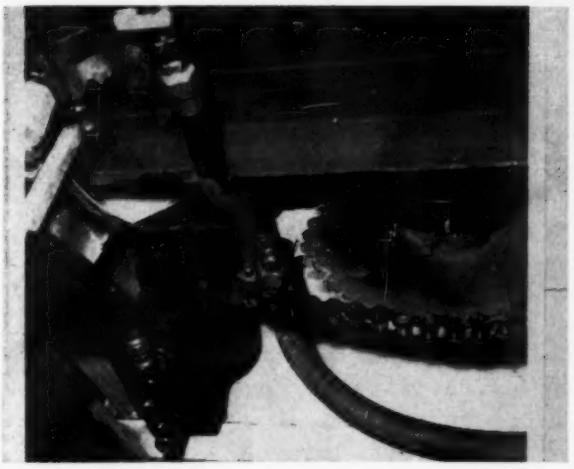
The four-way valve can direct pressure oil to either side of the fluid motor to give drum rotation in either direction. Putting the control valve in neutral stops rotation. No clutch or gears are needed. Any possibility of overload is cared for by a simple relief valve to protect the pump and motor.

The drum speed is controlled by engine speed, except for agitating on the road. Then the by pass valve in the hydraulic lines permits drum operation at 3 to 5 rpm. In addition drum rotation of 10 to 12 revolution rpm for mixing and discharge can be obtained at moderate engine speed. A 22 to 1 speed ratio between motor and drum was established. A chain drive is selected as being the most effective from the standpoint of both economy and low weight.

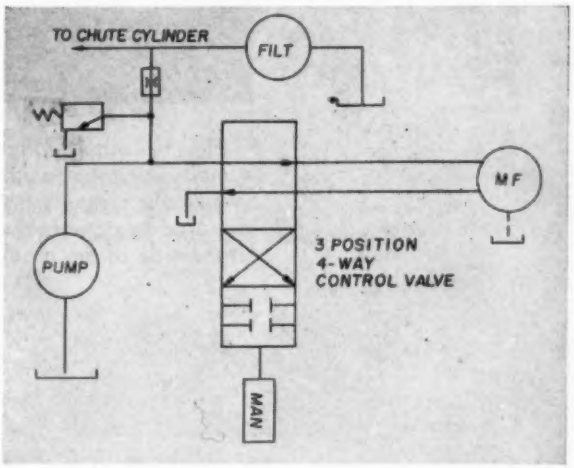
Elimination of the separate engine drive has made it possible to move the drum approximately 24 in closer to the cab. This new weight distribution placed 6000 pounds on the front axle and 18,000 pounds on the rear axle. This weight distribution and the weight savings of the new drive have added an extra yard of concrete to the payload.

Oil power now being available, it has been a simple matter to apply a hydraulic cylinder to the operation of the chute, making it unnecessary to do any manual lifting.

Our application of a commercial hydraulic pump and motor transmission has resulted in an entirely new kind of transit mixer providing higher payloads, improved quality concrete with minimum maintenance of equipment.



The hydraulic motor on the left produces 14 hp at 250 rpm to power the drum. Fluid motor speed is reduced through the chain drive to give a speed ratio of 22 to 1 between motor and drum.



Final circuit design involves only basic standard components making any servicing relatively simple.

* *The Hydrocreter is now being manufactured by the Imperial Construction Equipment Company, a division of Imperial Ready-Mix Concrete Company.*

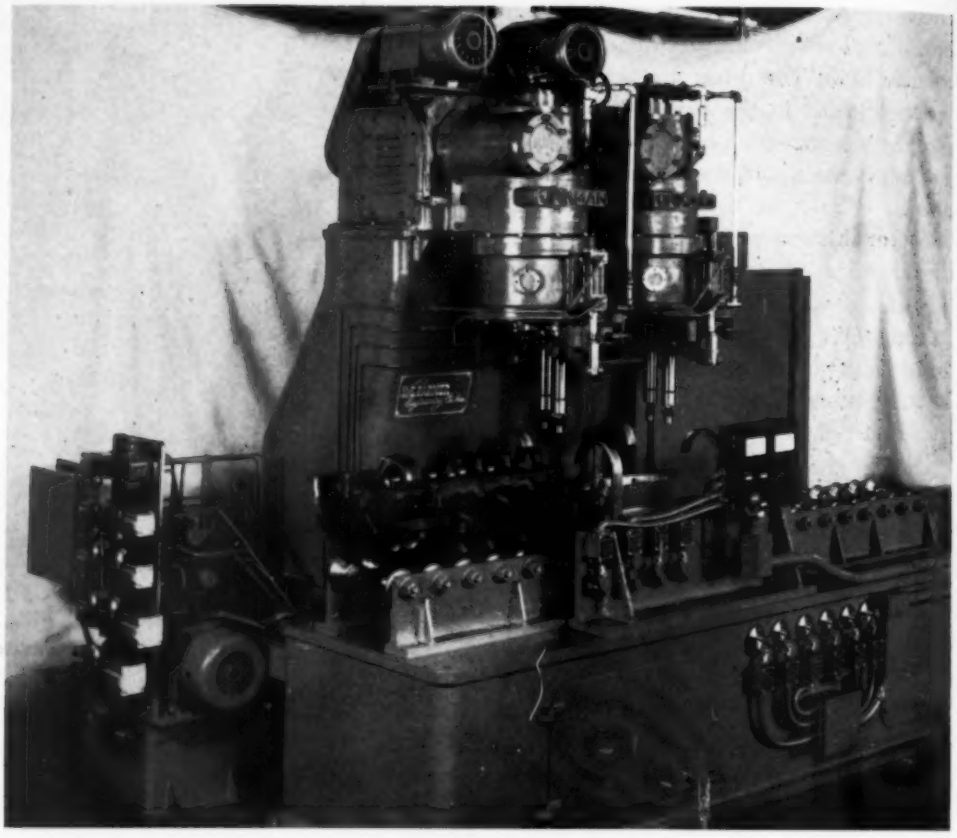


Fig. 1. Torque control is maintained by the electronic device mounted on the front panel. Each gage indicates the foot-pounds developed by each head. When the screws are properly tightened spindles stop rotating and raise. Fourteen limit switches are used to actuate the solenoid operated directional valves which are panel mounted at the side of the machine.

TORQUE CONTROL for screw setter . . .

uses electronic actuation of oil system

When is a screw turned down too tightly? The problem of just how tight should a fastening be comes up on assemblies where parts that should move—don't. They bind.

Showing the circuit and construction of an assembly machine built to J.I.C. Standards, Mr. Dyer describes how you can solve many of your torque control problems. The same principles used here have been successfully applied for torque control of taps, drills and torque control of milling cutters to indicate when cutters require grinding.

After one of these machines was completed, the customer asked for increased production. In a carefully planned work sheet Mr. Dyer shows the engineering steps to change the cycle time.

By Herbert A. Dyer

Chief Engineer H. E. Farmer Engineering Co. and Kirkman Torque Control Co., Detroit, Mich.

WE were confronted with a critical tightening requirement to be accomplished by a production machine for fastening the 10 main bearing cap screws on the new Chrysler V-8 motor block. There are two screws holding each bearing cap. The machine must tighten both screws at the same time and to equal torque to prevent distortion of the bearing cap.

The problem of torque control is solved by the use of a packaged electronic device which can be manually adjusted to vary the torque applied to the screws within the range of the available torque from the driving gear heads. On this machine, the maximum torque output of each of the two heads is 285 foot pounds. The torque load is equally divided through differential gearing and maximum available torque output for each spindle is 142½ foot pounds. The kinetic energy in each spindle is approximately 25 foot pounds, leaving 117½ foot pounds to work with.

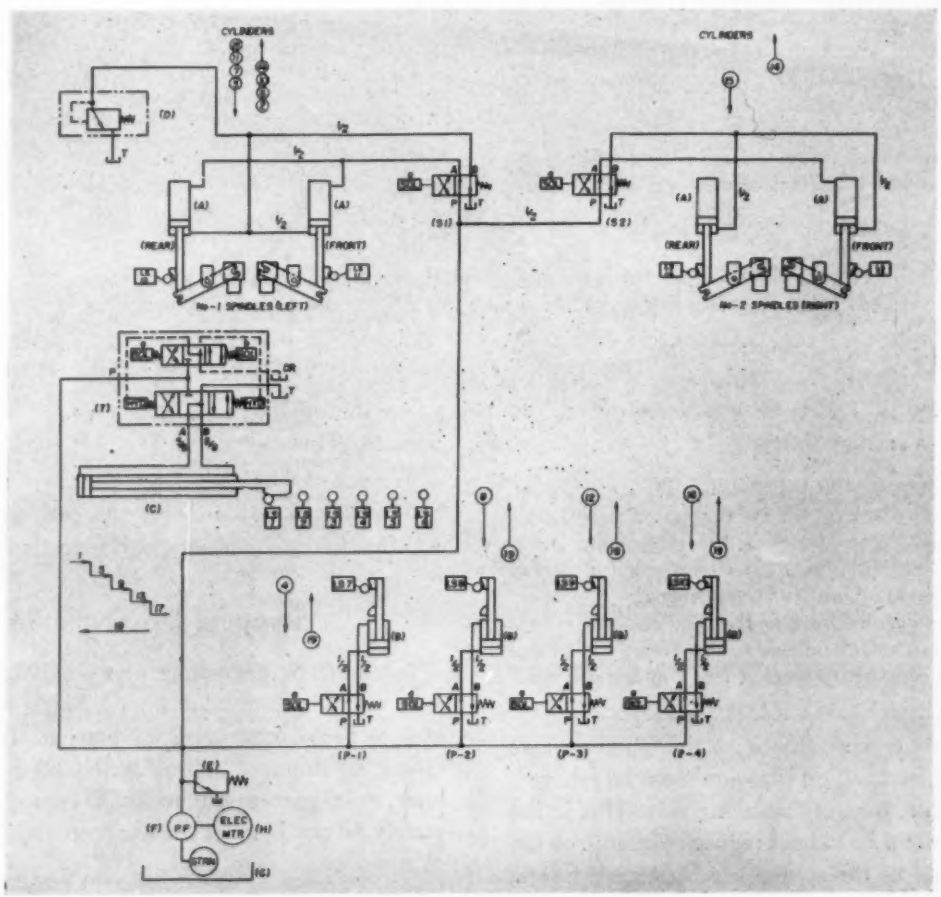
With the electronic torque control unit we are able to control the torque output within plus or minus one foot pound. On the Chrysler block, the requirements were 85 foot pounds torque load to each cap screw. Therefore, the only adjustment required to torque the cap screws from 25 foot pounds to 142½ foot pounds, is the turning of the knob on the torque control unit.

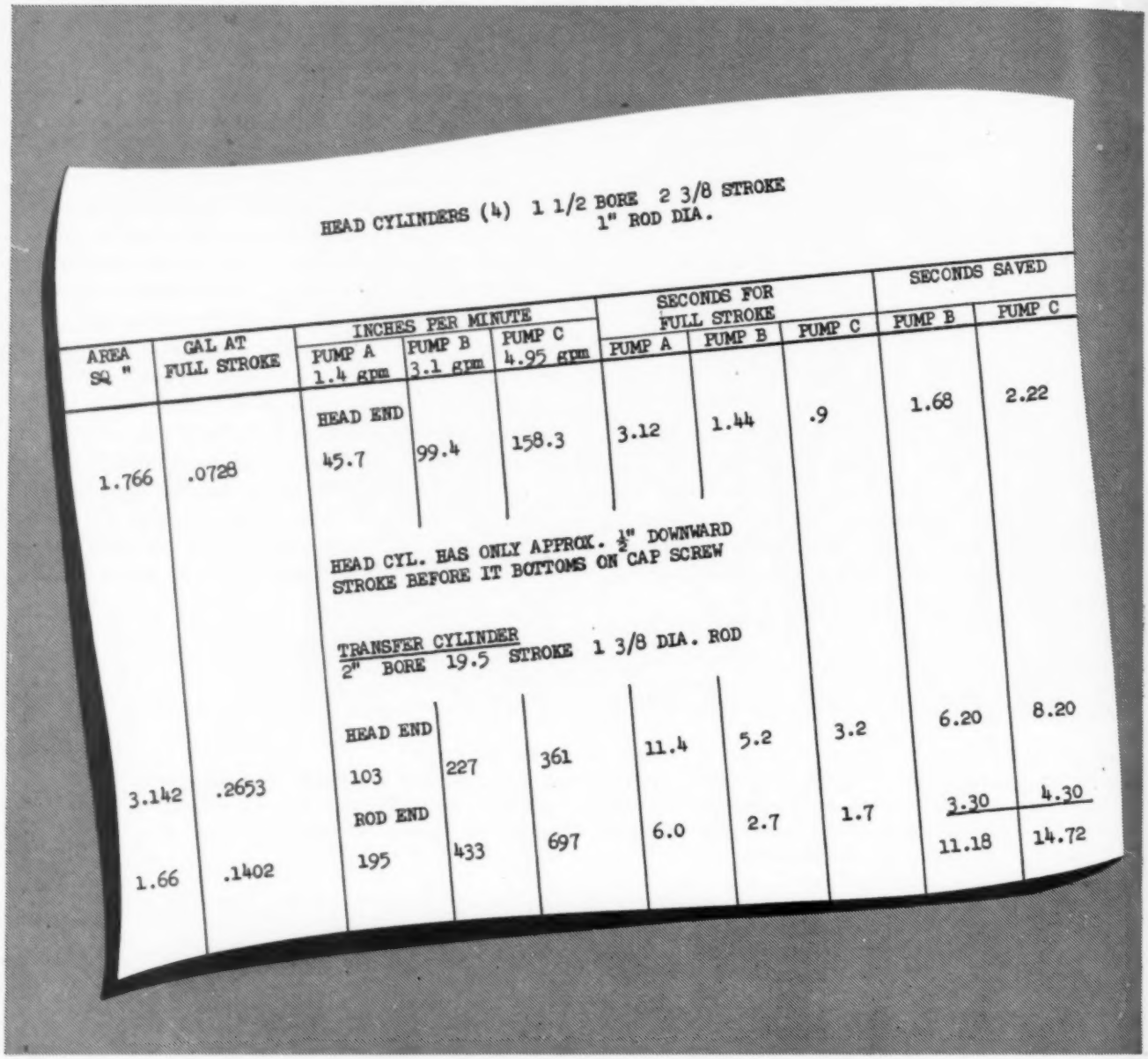
When the torque applied to the screws reaches the setting of the electronic torque control device, a clutch in the head opens to stop spindle rotation and the lift cylinders are actuated to raise the wrenches. Each head is separately controlled and operates independently.

The finished machine, seen in Figure 1, fits into a fast moving assembly line. Cylinder blocks are moved on conveyors to and from the machine. Hydraulic power is used to vertically move the wrench spindles; linearly index the cylinder block under the wrenches and power positive stops for locating the block at each position.

Two heads are used because the cap screws holding

Fig. 2. Complete hydraulic circuit for the screw setting machine. Cylinders A move the wrenches; cylinders B move the positive indexing stops and cylinder C transfers the work under the wrenches. Numbered arrows indicate sequence of operation for each motion.





HEAD CYLINDERS (4) 1 1/2 BORE 2 3/8 STROKE
1" ROD DIA.

AREA SQ "	GAL AT FULL STROKE	INCHES PER MINUTE PUMP A 1.4 gpm	PUMP B 3.1 gpm	PUMP C 4.95 gpm	SECONDS FOR FULL STROKE PUMP A	PUMP B	PUMP C	SECONDS SAVED PUMP B	PUMP C
		HEAD END							
1.766	.0728	45.7	99.4	158.3	3.12	1.44	.9	1.68	2.22

HEAD CYL. HAS ONLY APPROX. 1/2" DOWNWARD STROKE BEFORE IT BOTTOMS ON CAP SCREW

TRANSFER CYLINDER
2" BORE 19.5 STROKE 1 3/8 DIA. ROD

		HEAD END							
3.142	.2653	103	227	361	11.4	5.2	3.2	6.20	8.20
		ROD END						3.30	4.30
1.66	.1402	195	433	697	6.0	2.7	1.7	11.18	14.72

Fig. 3. Work sheet for determining pump selection to boost production at least 25 percent on the main bearing cap screw tightening machine.

No. 1. bearing cap (closest to flywheel) are offset. The sequences and cycle is as follows:

> **The block is placed in the machine, the cycle button is pressed, the block is clamped to the first stop. Looking at Figure 1, the head on the right side, No. 1 spindles in circuit drawing, tightens the cap screws on No. 2 bearing, then No. 3 and then No. 4. During these operations, the head on the left hand side is held out, the block is then indexd to the final position and both heads function tightening No. 1 and No. 5 bearing caps.**

It is of interest to note that once the spindles have contacted the cap screws, oil pressure must be relieved. To accomplish this, pressure reducing valve D is in the circuit. This valve opens to hold reduced pressure on the cylinder rod ends as the screws are tightened. Excess pump volume dumps to tank through this valve at the reduced pressure setting.

Accurate control of these functions is supplied by limit switch actuation and timer operation to properly energize the solenoid operated directional valves.

Stepping Up Cycle Time

After the first machine was put into operation, we were asked to determine what changes would be necessary to boost production 25 percent. This meant providing an output of approximately 60 motor blocks per hour, at 80 percent efficiency, as compared to approximately 48 per hour at the same operating efficiency.

Concluded on page 62

NO OTHER OIL HYDRAULICS PERFORM LIKE "COMMERCIAL" OIL HYDRAULICS

"COMMERCIAL" PUMPS — MOTORS *Operate with the*

FINEST GEARS GROUND

Perfect gears in the hydraulic pump are essential for a high performance hydraulic circuit. No other gears are equal to those which "Commercial" produces and uses. Gears in the "Commercial" pump are "The Perfect Twins." They have specially designed tooth contours which are precision ground. Perfect line bearing of the meshing teeth gives uniform, full width loading — so important for high efficiency, long life and quiet operation of the gear type hydraulic pump.

THE COMMERCIAL SHEARING AND STAMPING CO. YOUNGSTOWN 1, OHIO

QUALITY IN EVERY TURN

"COMMERCIAL"

Circle 29 on Reader Service Card

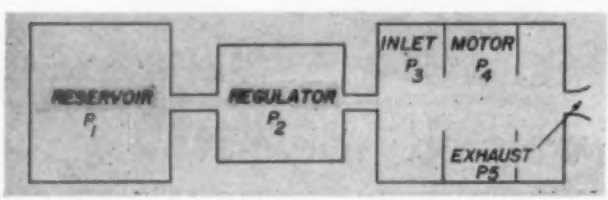
Ralph E. Middleton
Advisory Editor

Predicting Rotary Air Motor Performance

There is very little information available at present on the performance of high pressure pneumatic units for aircraft use. This article represents a worthwhile addition to the available literature, and it is offered in the hope that it will stimulate more thinking on the same lines throughout the industry.

By E. T. Kisselburg and W. F. McCombs

WITH the present trend towards increased usage of rotary type air motors, particularly in aircraft emergency systems, it becomes desirable to have a rational method of predicting performance of this type of motors. Inasmuch as the conversion of available energy to mechanical work is done by rotary motion instead of a reciprocating motion, a method of evaluating a continuous flow process becomes necessary.



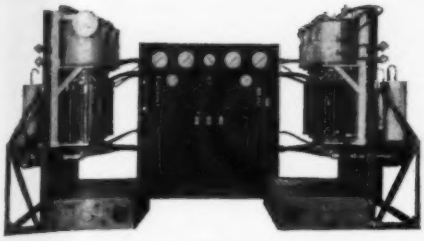
The usual emergency air system for a particular actuation may consist of an air reservoir, a pressure regulator and an air motor (plus the appropriate gearing and actuator) as shown above.

The theoretical performance curves for a frictionless motor of the Romec RD 7440A type can be developed as follows.

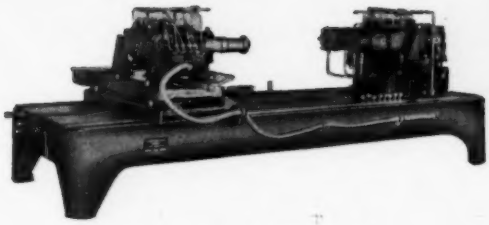
In a motor of this type, the work done is accomplished through the existence of a pressure differential across a gear tooth. The air passes through the motor at a constant pressure (neglecting leakage) and expansion takes place at the end of the cycle. No work is done upon expansion, but it is, of course, necessary to the process. This expansion, from P_3 to P_4, is prior to that occurring at the outlet orifice of the motor, from P_4 to P_5.

At any time the mass flow of air through the system must be constant. Therefore, the mass air flow through the exhaust ports (orifice) must be equivalent to the mass air flow through and around the air motor. The flow through the motor will consist of the air mass passing through the motor proper (the working ele-

E. T. Kisselburg and W. F. McCombs are Design Engineers, McDonnell Aircraft Corporation, St. Louis, Missouri.

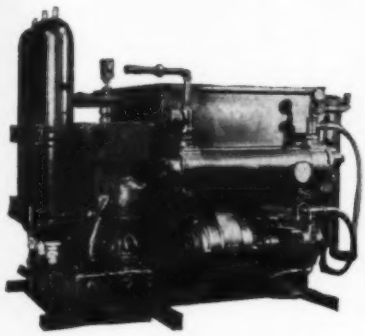


Universal Jet Fuel Nozzle Test Stand

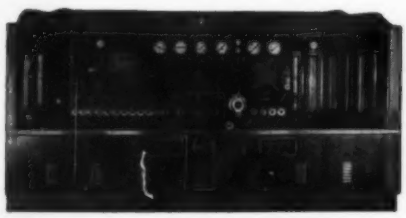


Universal Torsional Shaft Tester

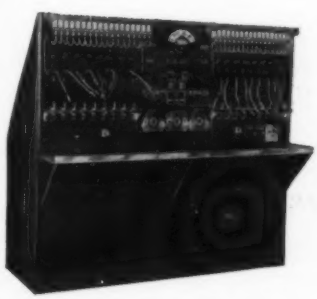
Universal Propeller Governor Tester



Rock Crusher Hydraulic Power Pack



Jet Engine Lube Pump Test Stand



Universal Magneto Test Stand

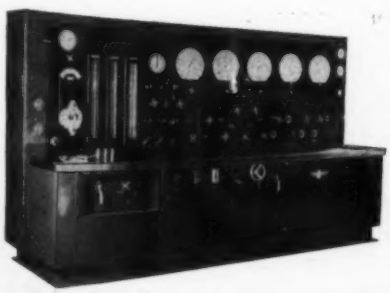
"But who tests the test equipment?"

Greer engineers test it—many times over, under conditions far more severe than normal operation—before it ever leaves the plant. For we know that testing equipment must have the complete confidence of those who use it. Greer equipment deserves that confidence, and has it—because it has earned it.

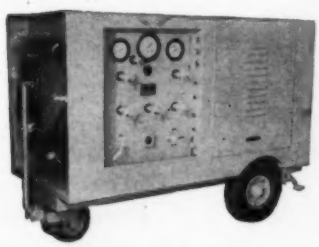
Not mass produced by the multi-thousands, each Greer test stand is painstakingly engineered, and is carefully tested in each stage of production for absolute accuracy. The men who design them and the men who build them have many years of specialized experience in this narrow field. It is experience that is difficult to find—perhaps impossible to match elsewhere.

In addition to standard models, many special machines have been developed to meet specific requirements. A staff of creative engineers is always available for a discussion of out-of-ordinary problems. Write or call today; no obligation.

GREER
TEST EQUIPMENT
FOR AVIATION AND INDUSTRY



Master Hydraulic Pump Accessory Test Stand



Portable Hydraulic Test Stand

Servicenter for Aircraft Accessories

GREER HYDRAULICS INC. · 454 EIGHTEENTH STREET · BROOKLYN 15, NEW YORK

Field Offices: Greer Hydraulics, Inc., 298 Commercial Building, Dayton, Ohio • 2832 East Grand Boulevard, Detroit, Michigan
Representatives: Thomson Engineering Service, 708 Hemphill Street, Fort Worth 4, Texas • Harold E. Webb, 918 N. Kenilworth Avenue, Glendale 2, California

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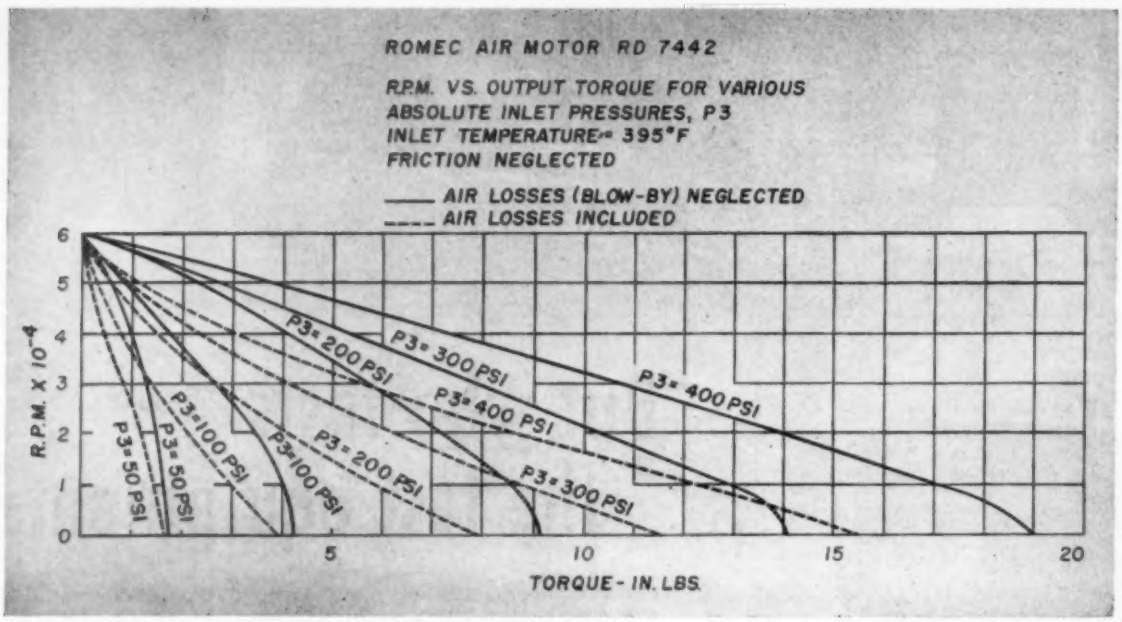
ROMEC AIR MOTOR RD 7442
R.P.M. VS. OUTPUT TORQUE FOR VARIOUS ABSOLUTE INLET PRESSURES, P3
INLET TEMPERATURE = 395°F
FRICTION NEGLECTED
AIR LOSSES (BLOW-BY) NEGLECTED
AIR LOSSES INCLUDED
R.P.M. X 10⁻⁴
TORQUE - IN. LBS.
P3 = 400 PSI
P3 = 300 PSI
P3 = 200 PSI
P3 = 100 PSI
P3 = 50 PSI

ments) plus the air mass passing around the working elements, due to leakage or blow-by.

The mass passing through the working elements of the motor will be:

$W_M = \gamma N \rho_3$

where W = lbs. of air flowing per unit time
γ = air motor displacement per revolution
N = rotational speed of motor
ρ_3 = density of air in the motor at inlet pressure

Since $\rho_3 = \dfrac{P_3}{RT_3}$

where P_3 = inlet pressure
R_3 = Gas Constant for Air
T_3 = inlet temperature, absolute

$W_M = \dfrac{\gamma P_3 N}{RT_3}$

According to Fleigner's empirical equations, see reference below,* when the pressure on the high side of the orifice is equal to or greater than twice the pressure on the low side, the mass flow through an orifice may be expressed as

$W_o = .53\ Ac\ \dfrac{P_H}{\sqrt{T_H}}$

where A = throat area of orifice
c = orifice coefficient
P_H = pressure on high side of orifice (abs.)
T_H = temperature (abs.) on high side of orifice
W_o = weight of air flowing per unit time

When the pressure on the high side of an orifice is equal to or less than twice the pressure on the low side, the mass flow may be expressed, according to Fleigner, as

$W_o = 1.06\ Ac \left[\dfrac{P_L\ (P_H - P_L)}{T_H}\right]^{1/2}$

where P_L = pressure on low side of orifice.

Thus, for the air motor,

$W_{o\,4\to5\,\text{exit}} = W_{M\,3\to4} + W_{o\,3\to4\,\text{Leadage}}$

Letting A_x = area of leakage orifices From pT. 3 to PT 4.
C_x = coefficient of leakage orifices
A_o = area of exhaust orifices
C_o = coefficient of exhaust orifices

$.53\ A_oC_oK_1 = \dfrac{\gamma P_3 N}{RT_3} + .53\ A_xC_xK_2$

solving for N

(1) $N = .53\ \dfrac{RT_3}{\gamma P_3}\left[A_oC_oK_1 - A_xC_xK_2\right]$

where $K_1 = \dfrac{P_4}{T_4{}^{1/2}}$ when $P_4 = 2P_5$

$K_1 = 2\left[\dfrac{P_5(P_4 - P_5)}{T_4}\right]^{1/2}$ when $P_4 = 2P_5$

$K_2 = \dfrac{P_3}{T_3{}^{1/2}}$ when $P_3 = 2P_4$

$K_2 = 2\left[\dfrac{P_4(P_3 - P_4)}{T_3}\right]^{1/2}$ when $P_3 = 2P_4$

For an adiabatic expansion across the motor (at the exit)

$T_4 = T_3 \left[\dfrac{P_4}{P_3}\right]^{\frac{a-1}{a}}$

The torque output of the motor is determined from the relationship,

(2) $2\pi M = (P_3 - P_4)\gamma$

$M = (P_3 - P_4)\ \dfrac{\gamma}{2\pi}$

where M = torque

From the formulas, (1) and (2) the curves of torque vs. motor speed can be calculated for any particular inlet pressure, P_3 and temperature, T_3.

*"Elementary Engineering Thermodynamics" (1941) V. A. and G. A. Young

Seals in a MINIMUM of space...

HERE'S HOW UNEEPAC WORKS

1. Lips are positioned diametrically and vertically by center section of sealing ring.
2. Spaces between lips and heels allow fluid pressure to act upon each lip.
3. Lips are protected by the projecting portion of center section against damage by excessive gland pressure.
4. Lips are supported to prevent collapse or distortion by excessive fluid pressure.
5. Each ring correctly centers itself on the preceding ring so that they align vertically and nest perfectly.

Uneepac

...the new Johns-Manville automatic ring packing

EQUIPMENT DESIGNERS are finding that this newest Johns-Manville packing development enables them to hold stuffing-box sizes to a minimum . . . thereby save both space and machining.

This ability of Uneepac to provide high sealing efficiency in minimum packing depth results from the fact that each ring is a complete self-contained packing unit. Uneepac is designed so that the center section of each ring positions the lips and protects them from excessive gland pressure. Header and follower rings are therefore seldom required.

In addition, Uneepac offers other advantages that are important both to the designer and the user:

SIMPLIFIED INSTALLATION—Each Uneepac ring centers itself on the preceding ring so that the entire set is aligned vertically and nested perfectly. This feature practically insures trouble-free installation.

MORE EFFICIENT SEALING—Because it is designed so that each lip is always exposed to fluid pressure, Uneepac has excellent pressure sensitivity . . . is instantly responsive to fluid pressure changes.

REDUCED FRICTION AND WEAR—The operation of this new automatic packing is completely independent of gland pressure. This reduces friction to a minimum—saves wear on both rod and packing—and contributes to longer life with corresponding reductions in down time for replacements.

Uneepac is available in sizes from ⅜" inside diameter to 63" outside diameter. For complete information, write Johns-Manville, Box 290, N. Y. 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville PACKINGS & GASKETS

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LOOK AT Pesco
performance charts FIRST

UNLOADING GEAR-TYPE HYDRAULIC PUMP

- **High pressure—1500 p.s.i.**
- **High capacity—2 g.p.m. at 1500 r.p.m., at 1500 p.s.i.**
- **High volumetric efficiency—96% at 3000 r.p.m., 1500 p.s.i.**
- **High torque efficiency—90% at 3000 r.p.m., 1500 p.s.i.**

The unloading gear pump is designed to replace conventional variable volume pumps with these advantages: lighter weight, longer service life, lower maintenance expense, lower initial cost. This pump will unload up to 90% of rated flow, the remaining 10% being bypassed through a relief valve to obtain zero flow.

"Pressure Loading" provides automatic compensation for wear on the bearing and gear running surfaces and makes possible high efficiencies and long, trouble-free service life.

For complete specifications and performance chart, write today.

engineering Pesco production
PRODUCTS DIVISION
BORG-WARNER CORPORATION
24700 North Miles Road • Bedford, Ohio

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Correction for a different condition of inlet temperature, T_3, can be easily made by adjusting r.p.m. by the ratio

$$\left[\frac{T_{3new}}{T_{3old}}\right]^{1/2} \quad N\ old = N\ new$$

In this manner performance curve for other inlet temperatures can be obtained readily.

The state of the air, P_3, T_3, V_3, depends upon the type of expansion it undergoes from P_1 to P_3. It is most likely, considering the expansion time usually involved in such an emergency system, that the process will closely approximate an isothermal change of state in the reservoir and across the regulator. In this case,

$$T_1 = T_2 = T_3$$
$$P_2 = P_3 \text{ (neglecting orifice effect at inlet)}$$

In the reservoir, since the volume and temperature remain constant, the change of state will be at any time, t,

$$P_{1t} = P_1 \times \frac{(M_1 - \Delta M_t)}{M_1}$$

where the original mass of air in the reservoir is,

$$M_1 = \frac{P_1 V_1}{RT_1}$$

$$\text{and } \Delta M_t = \frac{\gamma N P_3}{RT_1}$$

The efficiency η is defined as

$$\eta = \frac{2\pi MN}{Q}$$

where for a given value of P_3 and T_3,

M = Torque developed
Q = energy available in mass of air passing through motor per second

Treating air as a perfect gas,

$$Q = W C_p (T_3 - T_5) J$$

where W = lbs. air passing per second through exhaust ports
C_p = specific heat at constant pressure for air
J = Joules constant—mechanical equivalent to heat

For the Romec RD 7440A air motor,

$\gamma = .31$ in.^{3}
$A_o = .0764$ in.^{2}
$A_x = .0245$ in.^{2}
$C_o = .61$
$C_x = .50$

Substituting these values into equation (1), at a temperature of 395°R, the curves on the accompanying graph are obtained.

For purposes of illustration, the efficiency index will be computed at P_3=200 psi. and RPM=30,000.

Torque = 3.07 in-lbs from curves

$$W = .53(.0764)(.61)K_1$$

$$P_4 = \frac{P_3 - 2\pi M}{\gamma}$$

$$= 200 - \frac{2\pi(3)}{.31} = 139 \text{ psi.}$$

$$T_4 = T_3 \left[\frac{P_4}{P_5}\right]^{\frac{\alpha-1}{\alpha}}$$

$$= 395 \left[\frac{139}{200}\right]^{.286} = 356 \text{ °R}$$

$$W = \frac{.53(.0764)(.61)(139)}{18.87} = .182 \#/\text{sec.}$$

$$T_5 = T_3 \left[\frac{P_5}{P_3}\right]^{\frac{\alpha-1}{\alpha}}$$

$$395 \left[\frac{14.7}{200}\right]^{.286} = 187 \text{°R}$$

$$Q = W\, C_p\, (T_3 - T_5)\, J$$
$$= .182\ (.24)\ (208)\ (778)(12) = 84{,}600 \#/\text{sec}$$

$$\eta = \frac{2\pi MN}{Q}$$

$$= \frac{2\pi\ (3)\ (500)}{84{,}600} = .111$$

H.P. = 1.43 = Horse power output of motor.

To produce the same torque, 3.0 in-lbs, at P_3=100 psi., the motor speed is 11,100 RPM. Similar calculations will show the efficiency to be,

$$\eta = \frac{2\pi\ (3)\ (185)}{20{,}700} = .169$$

H.P. = .523

showing the increased efficiency to be obtained by operating at lower inlet pressures, P_3.

If the motor is operated at 400 psi. and 30,000 RPM, producing a torque of 6 in-lbs, the efficiency will be

$$\eta = \frac{2\pi\ (6)\ (500)}{197{,}000} = .0956$$

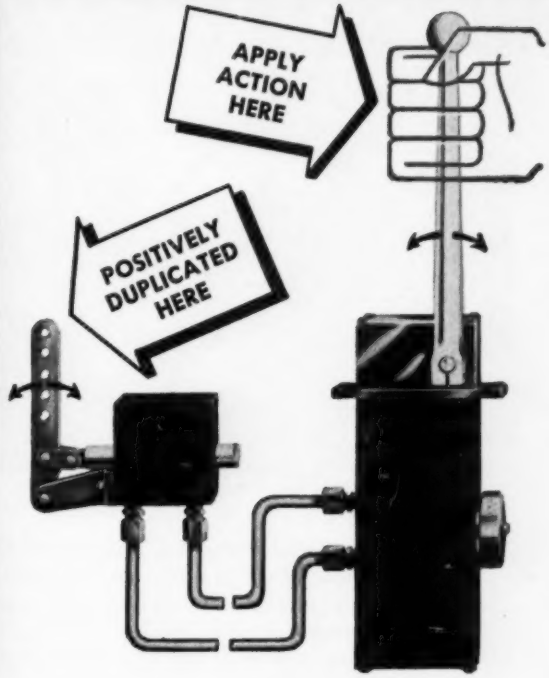
H.P. = 2.86

These illustrations, together with the performance curves, indicate the advantages of operating, whenever possible, at lower inlet pressures and lower motor speeds. Of course, lower output torques are thus produced, but these can be increased at the actuator by means of higher gearing. Naturally, the gearing efficiency must be considered, for it could be low enough to nullify any gain in thermal efficiency. The increased time required for operation must also be considered as it may be greater than is permissible.

The theory presented here is, admittedly, of a somewhat elementary nature. Such form lends itself readily to rapid calculations and estimations. It can be refined further, if desired, to include such effects as reversal of momentum of the air between entering and leaving the motor, expansion other than adiabatic, etc. For this reason the curves obtained must be considered as an optimum and in practice, for any particular value of speed, the torque output will be less than indicated thereon.

SUPERDRAULIC

PUMPS • VALVES • TRANSMISSIONS • TEST STANDS • REMOTE CONTROLS



POSITIVE REMOTE CONTROL

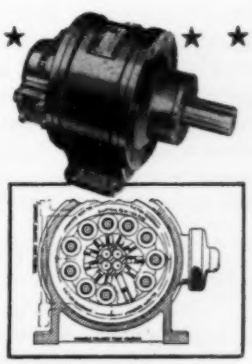
A simplified device for positioning, controlling and duplicating movement at a distance. Automatically compensates for contraction and expansion of fluid media. Operates with a smooth, rigid, silent and sensitive stroke. Many superior engineering features.

APPLICATIONS INCLUDE: processing machinery, assembly fixtures, air and marine craft, earth moving, farm, railroad and construction equipment, machine tools, test cells and military vehicles. Write for catalog.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

FAMOUS SUPERDRAULIC HIGH PRESSURE PUMP

Develops up to 60 H.P. at 5,000 P.S.I. Let us quote on your requirements.



Superdraulic CORPORATION

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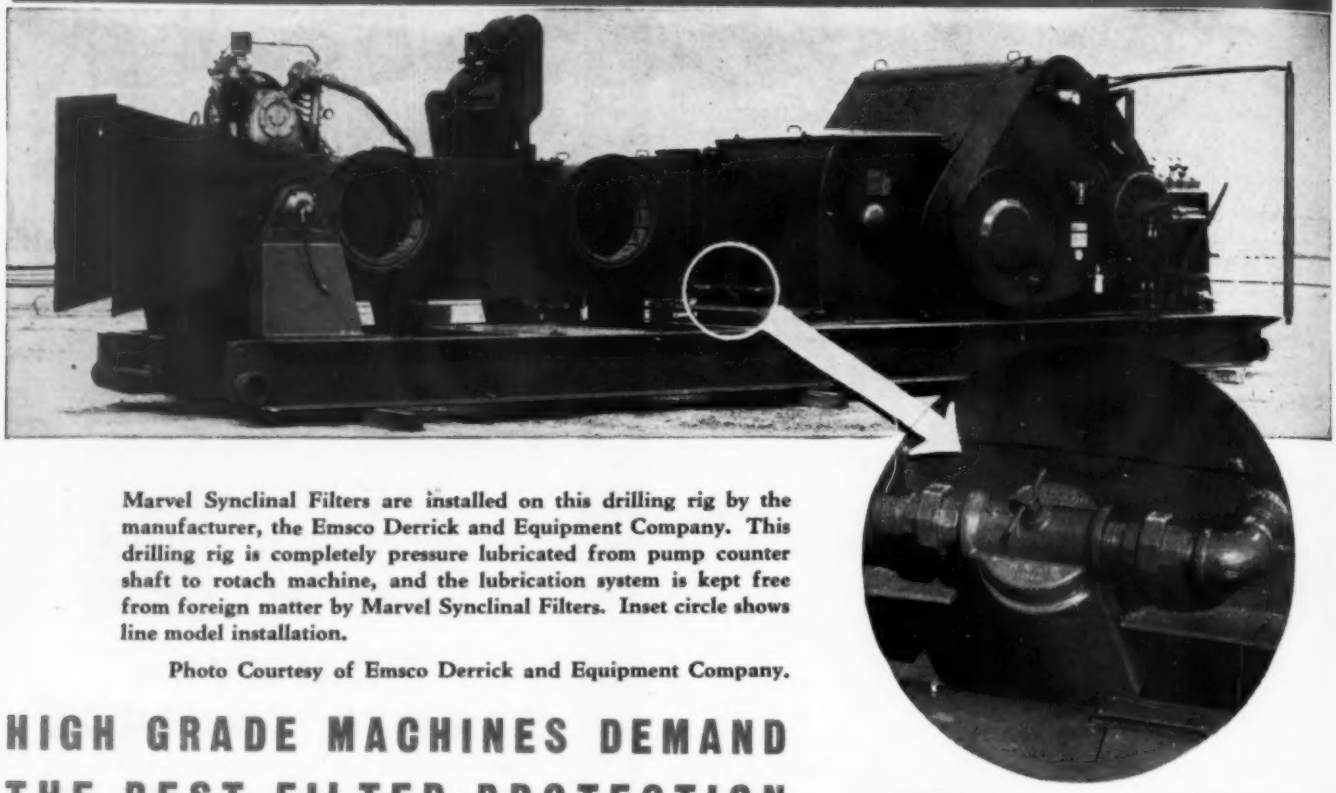
ANOTHER MANUFACTURER SPECIFIES
MARVEL SYNCLINAL FILTERS



Marvel Synclinal Filters are installed on this drilling rig by the manufacturer, the Emsco Derrick and Equipment Company. This drilling rig is completely pressure lubricated from pump counter shaft to rotach machine, and the lubrication system is kept free from foreign matter by Marvel Synclinal Filters. Inset circle shows line model installation.

Photo Courtesy of Emsco Derrick and Equipment Company.

HIGH GRADE MACHINES DEMAND THE BEST FILTER PROTECTION

That is why over 260 Original Equipment Manufacturers, like Emsco, specify Marvel Synclinal Filters as original equipment; thus they assure their machines longer life, operating with all the productive efficiency built into them by the makers.

Less Maintenance plus Greater Efficiency
equals **MORE PRODUCTION**

That is the reason why a great many machine manufacturers and users are specifying Marvel Synclinal Filters because they offer the greatest amount of ACTIVE filtering area within the smallest amount of space, allow longer periods of operation between cleaning and are so simply designed that any workman can quickly disassemble, clean and reassemble on the spot. Sturdily constructed, Marvel Synclinal Filters have no moving parts, no complicated assembly to require special attention. Line models operate in any position and may be serviced without disturbing pipe connections.

5 to 100 G.P.M. Sizes in Sump and Line Types

Both models are available in mesh sizes from 30 to 200. For efficient filtration of non-corrosive liquids in all hydraulic and low pressure systems, Marvel has the right filter protection for your machine.

Sump Type (Cutaway)

Line Type (Cutaway)

For complete Engineering Data write for Folder 105

Meets J.I.C. Standards

MARVEL ENGINEERING COMPANY
625 W. Jackson Blvd. Chicago 6, Ill.

Circle 31 on Reader Service Card

application and performance of NEW COMPONENTS

Split Flange Hose Clamp

Anchor Coupling Co., Inc.
Libertyville, Ill.

Sizes: Clamp or pressed-on type couplings in straight or angle styles of one or two wire braid hose from ½ ID through 2 in. ID.
Application: For high, medium or low pressure service.
Design: The seal of clamp consists of an "O" ring which eliminates the need for tapered threads. There is no wedging action to cause distortion in valve bodies, cylinders, or any other piece of hydraulic apparatus. The bolt centers are located on the centroid so that any applied forces are equalized. This feature helps maintain a permanent, leakproof seal so that the split-flange type clamp is ideally suited for the toughest kind of service.

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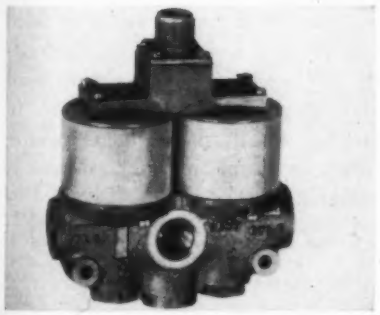

Aircraft Pneumatic Valves

Adel Division of General Metals Corporation,
Burbank, Calif.

Types: 3- and 4 way solenoid operated valves, thermal relief valves and check valves for aircraft pneumatic control systems.
Design: Valve illustrated is 4-way solenoid operated and provides safe, dependable operation with instantaneous reaction at standard working pressures up to 3000 psi. Leakages are cut to a minimum and maximum efficiency is assured under all service conditions. This control equipment has dependable and efficient characteristics and are ideal where pneumatic systems are specified.

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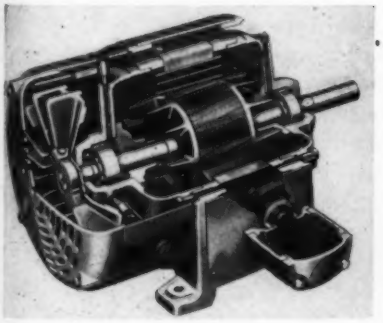

Explosion-Proof Motor

U. S. Electrical Motors, Inc.,
Los Angeles, Calif.

Designation: Types SE and SES
Sizes: 3 to 74 hp.
Design: Carries the Underwriters' label in Class I, Group D, for highly inflammable gases and volatile liquids, and Class II, Groups F and G, for combustible dusts. Features incorporated include: sealed terminal, elongated spark-arresting bearing sleeves, streamlined housing, hi-draft ventilation, removable cover, split hub fan, normalized castings, lubri-flush bearings, asbestos-protected windings, and solid, centricast rotor. Being completely sealed, this motor gives protection against external hazards.

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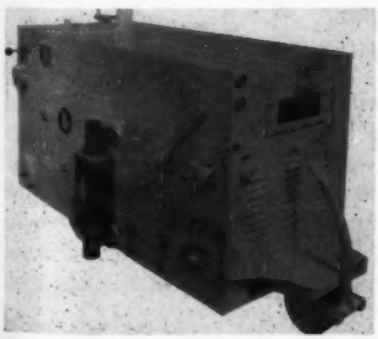

Hydraulic Package Power Unit

The Rucker Company, Oakland, Cal.

Sizes: Fixed volume pumps up to 60 gpm at 2000 psi; variable volume pumps up to 5000 psi and 75 hp.
Application: Designed to provide hydraulic power for testing equipment, modernizing older machinery and for emergency power. Testing of aviation and automotive equipment and the powering of machine tools and processing machinery.
Design: Portable unit having multiple valve combinations and simple hand control of two pressure lines permit pump to take suction from built-in 100 gallon tank or from an outside source. Unit has micronic filter, relief valve, flowmeter, pressure gauges, and electric controls. Meets J. I. C. specifications.

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FOR HIGHER EFFICIENCY

in high-pressure oil-hydraulic circuits

DENISON HydrOILics

Pumps and Controls

Meet Circuit Needs to 5000 psi

1. DENISON'S SURGE-DAMPING CONTROL *eliminates shock without affecting other circuit functions!* About the size of a garden-hoze nozzle, it is easily installed in any circuit. Adjusts automatically to any working pressure . . . acts with split-second speed . . . can't retard cycling speed.

2. One of the many Denison high-pressure high-volume pumps for either constant or variable volume delivery. Volume control by stem, handwheel, or pressure compensation. Capacities: 2 to 35 gpm. Simplified axial-piston design — rugged, dependable, highly compact.

3. Spool sticking is eliminated in long-cycling, high-pressure operations by Denison's pilot operated 4-way Solenoid Valves. Using system pressures to move the spool through either internal or external pilot action, they assure smooth, quick positive action under all conditions. ¾" and 1½" sizes.

Denison has the answers to today's increasing needs for complete packaged power units built for long life and extra efficiency in high pressure oil-hydraulic systems of almost every type. Write for information on HydrOILic Pumps, Valves, Controls, Pumping Units, Fluid Motors and other components or for recommendations on your specific needs!

The DENISON Engineering Co., 1166 Dublin Rd., Columbus 16, Ohio

DENISON
Pumps and Controls

Circle 32 on Reader Service Card

Four-Way Hydraulic Valves

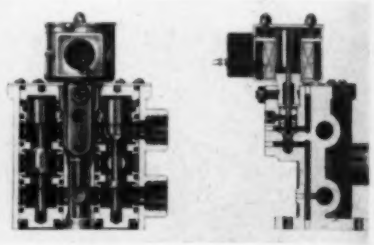
Barksdale Valves, Los Angeles, Calif.

Designation: Series 1046

Application: Control of air, water and light oils to 150 psi.

Sizes: ¼, ⅜, ½, and ¾ in. I.P.S.

Design: Pilot operated, solenoid controlled for continuous operation up to 600 cycles per minute. The two main valve members are disposed in vertical alignment with two parallel bores in the valve body. They move



up and down simultaneously to open and close their respective inlet and exhaust ports. There is an integral 3-way pilot valve. When the solenoid is deenergized the valve members are held in their normal "up" positions by a combination of fluid pressure and light springs. Energizing the solenoid opens the pilot valve to supply pilot pressure to shift the main spools. Cast bronze body; auxiliary manual control is available.

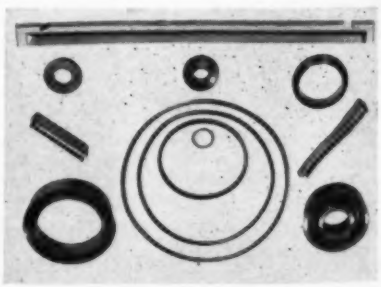
Circle 105 on Reader Service Card

Packing Compound

Acushnet Process Co., New Bedford, Mass.

Designation: X 1692

Application: Developed to restrain shrinkage and swelling, the twin problems in oil resistant applications.



Properties: A Buna N compound of 70 Shore "A" durometer; has a minimum swell in low aniline point oil, and a minimum shrinkage in high analine point oil. Will not corrode or otherwise damage such metals as aluminum, magnesium or stainless steel.

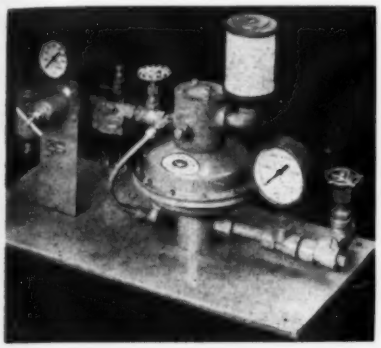
Circle 106 on Reader Service Card

Hydraulic Power Package

Sprague Engineering & Sales Corp., Gardena, Calif.

Designation: Model S-440

Application: For oil or water service; capable of output fluid pressures to 30,000 psi from 100 psi plant supplied air pressure.

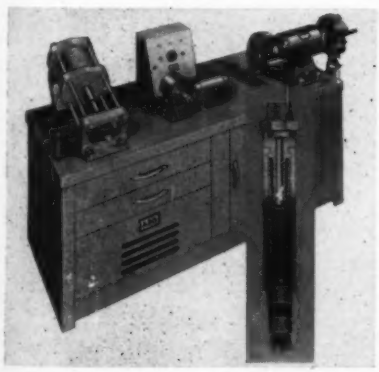


Design: Requires only two connections—one to plant air supply line and the other to manifold, etc., from outlet port. Includes air operated pump, air muffler, air filter, air lubricator, air regulator; valves and gauges all mounted on a masonite base. Unit weighs 45 pounds. Operates on the principle of differential areas.

Circle 107 on Reader Service Card

Machine for Making Hose Assemblies

Pyles Industries, Inc., Detroit, Mich.



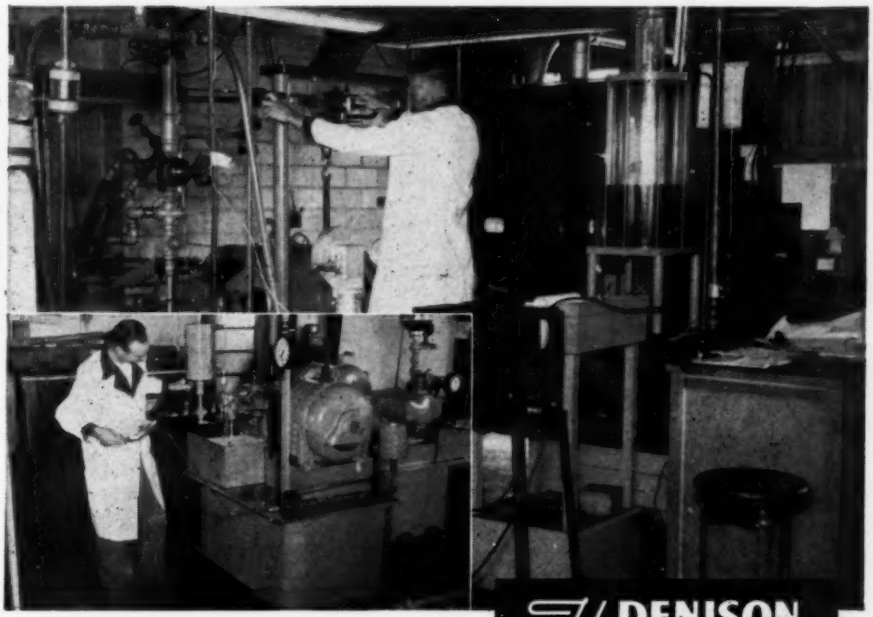
Design: This is a desk-size machine having a cutting wheel to cut hose to length. A wire wheel attachment is used to skive each end of hose. A power spinner inserts the hose coupling; a press swages the coupling permanently to the hose.

Application: Machine eliminates need for a big finished hose inventory, removing risk of costly machine down-time for lack of hard-to-get replacement hose.

Circle 108 on Reader Service Card

HYDROILIC RESEARCH DOES IT

with constant advancement in designs and methods



DENISON Hydr OIL ics

Pumps and Controls

Shown on Opposite Page are Typical Examples

Applying the full advantages of oil-hydraulic equipment to new requirements that play a major part in today's fast-moving industrial progress, has been the work of a continuous research and development program at Denison for many years.

As a result, press equipment has been reduced in bulk and complexity . . . its speed and efficiency have been increased for all types of production jobs . . . and newly developed all-automatic control features slash costs even on short run production jobs. Pumps of improved design, with full emphasis on efficiency at high pressures, are now a reality. Greater accuracy has been incorporated into pressure controls for all types of circuit needs up to 5000 psi. Tooling designs and methods that reduce scrap losses, boost production rates and improve the quality of work are now in wide, daily use because of procedures developed at Denison.

Recently, special research in applying high-pressure hydraulics to new and bigger commercial and defense-production needs has brought remarkable gains in many phases of industry.

This continuing research program has made Denison a preferred source for new, improved equipment, better methods, and advanced ideas — like the valves that *eliminate* hydraulic shock and spool-sticking, described on the opposite page. You can count on Denison for *better* hydraulic equipment.

WATCH FOR NEW PRODUCTS TO BE ANNOUNCED SOON!

The DENISON Engineering Co., 1166 Dublin Rd., Columbus 16, Ohio

DENISON
Oil-Hydraulic Equipment

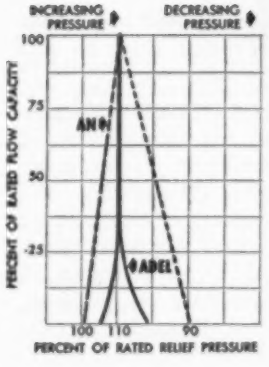
Circle 33 on Reader Service Card

100% to 400%
GREATER
FLOW CAPACITIES
than those required by
AN STANDARDS!

ADEL 3000 PSI POPPET
type RELIEF VALVES
¼", ⅜" & ½" line sizes are QPL equipment
per MIL-V-5523

FLOW CAPACITY DATA (gpm)

	LINE SIZE			
	¼"	⅜"	½"	¾"
AN Standard	1.2	3.5	6	16
ADEL	6	10	14	32



ADEL 3,000 psi Class CD poppet type relief valves provide maximum flow capacity for a given line size. All conform strictly to AN 6279 Envelope. Extremely compact, light weight construction permits savings in weight of up to twice that of competitive valves. Zero internal leakage requirements are met at a pressure 30 psi less than dynamic cracking pressure, and 30 psi less than dynamic reseating pressure as defined by MIL-V-5523. Pressure variation from cracking point to maximum rated capacity is far less than that required by AN standards.

Make comparisons and see for yourself why these outstanding valves are unexcelled for high pressure aviation hydraulic performance.

ADEL also produces the most complete line of AN Standard aircraft Clips and Clamps available.

For complete engineering specifications and counsel, address: ADEL DIVISION, GENERAL METALS CORPORATION, 10775 Van Owen St., Burbank, Calif.

ADEL LEADER IN HYDRAULICS
Manufacturers of Aircraft Hydraulic Control Equipment

DIVISION OF GENERAL METALS CORPORATION • BURBANK, CALIF. • HUNTINGTON, W. VA

CANADIAN REP. RAILWAY & POWER ENGINEERING CORPORATION, LIMITED

Circle 30 on Reader Service Card

Water Oil Separator

Honan-Crane Corporation, Lebanon, Ind.

Designation: Houdaille PurDry Water-Oil Separator.

Application: Provides a simple, practical method of separating water from oil. The presence of water in oil promotes the formation of sludge containing products of oxidation which clog channels and orifices in bearings, pumps, cylinders and valve mechanisms. The unit also removes solid contamination, acids and other sludge-forming products of oxidation. The unit may be operated as a continuous by pass filter.

Circle 109 on Reader Service Card

Filter-Drain for Air Lines

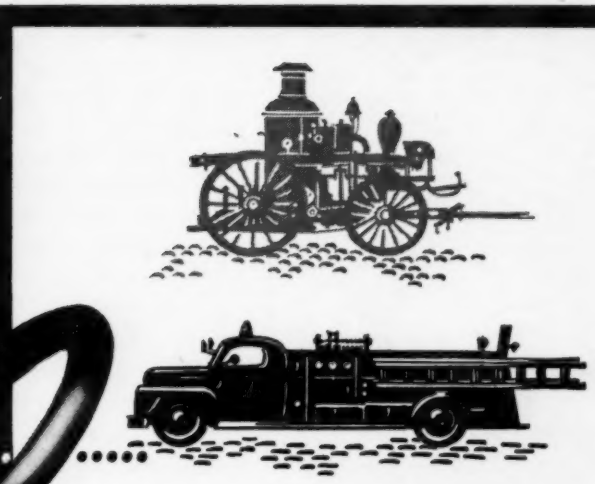
C. A. Norgren Co., Englewood, Colo.

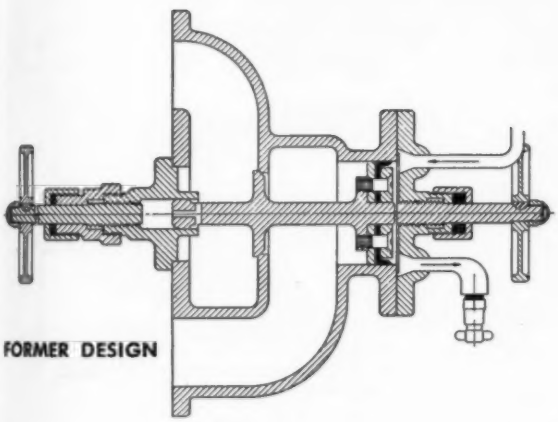
Sizes: ¼, ⅜ and ½ in. pipe thread sizes. 0 to 35 cfm flow at pressures from 0 to 150 psi in temperatures from 40 to 120 degrees F.

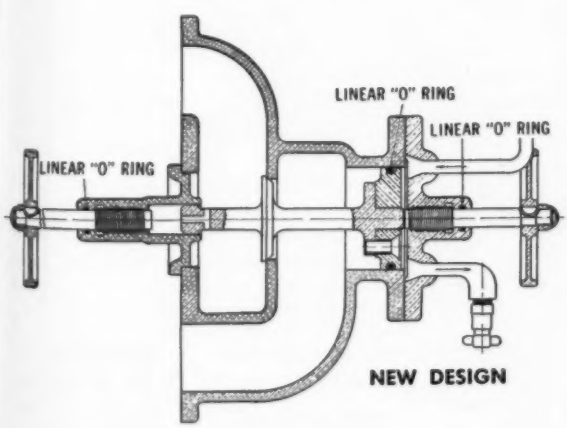
Application: Removal of liquids and solids from compressed air lines with automatic drainage of collected liquids. It is designed for use in air lines to portable air tools, air cylinders and air-powered machines where manual draining is not desired or practical. Unit has an extremely low pressure drop, and operates automatically under constant or fluctuating air pressure and air flow. It also continues to operate when the flow of air is cut off.

Circle 110 on Reader Service Card

Results from designing for simplification.....







More power and less bulk—higher pressures and safer operation—greater speeds and less wear—more economical use of scarce materials . . . these are industry demands that every designer must meet—now!

Where simplification seems impossible because of sealing difficulties with—type of fluid handled, extent of pressures exerted, wide temperature changes, abrasion—have you considered the wide application possibilities of LINEAR "O" Rings?

A typical example of how LINEAR "O" Rings make design simplification possible can be illustrated by this redesigned relief valve. Here, *valuable metal was saved—five parts were eliminated—weight was reduced—production costs were reduced 22.4% . . . and most important, the profit margin on each unit was substantially increased.*

To build it better—to make it simpler—to provide a greater profit margin per unit . . . let LINEAR help you with your packing and sealing problems.

"PERFECTLY ENGINEERED PACKINGS"

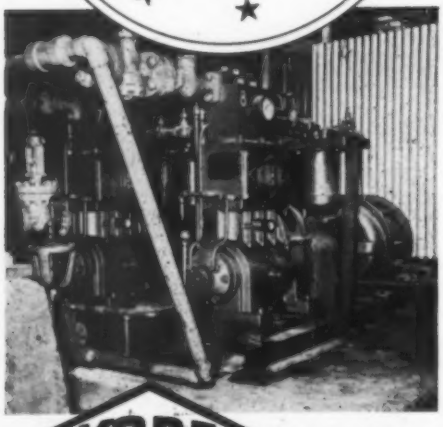
LINEAR

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILADELPHIA 35, PA.

Circle 37 on Reader Service Card

STAMP OF APPROVAL

A major steel fabricator ordered four Kobe Triplex Pumps to test and expand large diameter welded pipe. Has since ordered 14 more.



KOBE Heavy Duty High Pressure

Triplex Pumps

Case History A 3: In the plant of a major steel fabricator four Kobe pumps were tried initially to supply the accumulator system of a machine for expanding and testing large diameter welded pipe. This use of multiple pumping proved so successful in providing operating flexibility with minimum standby investment, that 14 more Triplexes have been specified for the identical service by the same company. *If you have a heavy duty production problem that calls for high pressure hydraulic power, investigate Kobe's "Power in a package."*

Features:

- Pressures—To 5,000 psi (standard) To 20,000 psi (special)
- Volumes—To 60 g.p.m.
- Power Ratings—15, 30, and 50 H.P.
- Integral Double Reduction Gears
- Integral Electric Drive (optional)
- Easily interchanged Plungers and Liners
- Built-in Pressure Lubrication
- Easily Accessible Ball Type Check Valves

Write for Bulletin
KOBE INC., Division of Dresser Equipment Co., 615 NBC Bldg., 815 Superior Ave., N.E. Cleveland 14, Ohio

KOBE INC.
Division of Dresser Equipment Co.
Plant: Huntington Park, Calif. — Representatives in CLEVELAND, Pittsburgh, New York, Houston, Oklahoma City.

Circle 65 on Reader Service Card

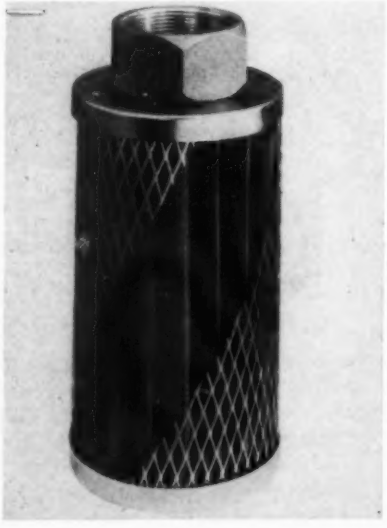
Cylindrical Accumulator
Superior Hydraulics Division, Superior Pipe Specialties Co., Cicero, Ill.

Sizes: 1½, 3, 5, 7, 9 gallon capacity.
Design: This new accumulator is a double wall, "O" ring sealed, piston type, cylindrical unit. Both aviation and industrial models are planned. A standard 5 gallon aviation type has been reported capable of meeting requirements of MIL-A-5498 A. Design is for 3000 psi maximum hydraulic working pressure and air precharge pressure to fit a wide range of work conditions such as, surge damping or a given storage pressure requirement.

Circle 111 on Reader Service Card

Hydraulic Oil Filter
Marvel Engineering Company, Chicago, Ill.

Sizes: 75 and 100 gpm.
Designation: Synclinal.

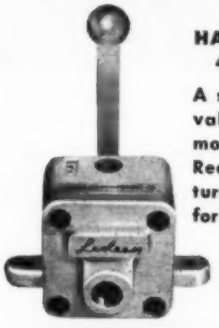


Application: Addition of these two sizes provides a line of eight filter sizes from 5 gpm to 100 gpm. The large sizes provide adequate filter capacity for the many applications which had required multiple installation of filters to gain adequate filter capacity. Use of a single unit of sufficient capacity simplifies maintenance.
Design: The 75 gpm filter is only 12½ in. overall including the coupling nut, and 6 in. in diameter. The coupling nut fits a 2½ in. pipe. The 15 corrugations of wire mesh total 412 square inches of active filter area. The 100 gpm model measures 14 in. overall, 6½ in. in diameter with 501 sq. in. of filter area.

Circle 112 on Reader Service Card

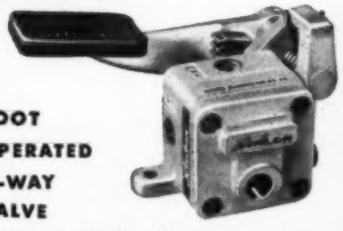
Ledeen VALVES

14 Models for Positive, Easy Actuation of Air or Hydraulic Cylinders



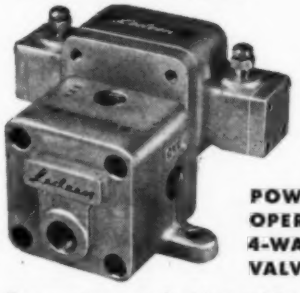
HAND OPERATED 4-WAY VALVE

A simple, economical valve, suitable for most requirements. Requires only light turning effort. Built for long life.



FOOT OPERATED 4-WAY VALVE

Leaves hands free for other work. Requires only light pedal pressure. Works like accelerator throttle. Particularly valuable for women workers.



POWER OPERATED 4-WAY VALVE

For remote control with or without electricity. Can be controlled by microswitch, cam, finger or toe operation.

Ledeen Valves embody the rotating disc construction, and are designed for controlling the flow of air, oil or water. They are made in 14 different models for 5 different cycles, in 6 sizes.

Write for Bulletin 510

Ledeen Mfg. Co.
1610 So. San Pedro St.
Los Angeles 15, Cal.

Circle 39 on Reader Service Card

Remote Oil Pressure Loader

Askania Regulator Company, Chicago, Ill.

Application: Used for manually controlling oil pressure to devices normally operated automatically.

Design: Gauges on the panel-mounted unit indicate both automatically and manually controlled pressures. Standard output pressure range is 0-60 psi with an oil supply pressure of 100 psi. Variations in supply pressure do not affect output pressure unless supply pressure falls to within about 5 psi of output pressure.

Circle 113 on Reader Service Card

Aircraft Fluid Line Identification

W. H. Brady Company, Chippewa Falls, Wis.

Type: Self-sticking tape markers.

Material: Made of a durable cotton cloth with a silicone plastic coating, the markers come mounted on handy dispenser cards.

Application: Using color and symbols in conformance with Air Force-Navy Aeronautical Standard AND-10375, these markers are used to identify the fluid in a line or the function of a line.

Circle 114 on Reader Service Card

Air Cylinders

H. G. Weber & Co. Inc., Kiel, Wis.

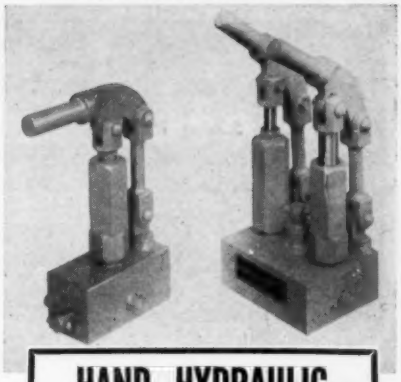
Designation: "Web-Aire"

Sizes: Standard 1, 2, 3, 4, and 6 inch stroke.

Design: Features interchangeable mountings; foot and clevis mounted adapters are available. The cylinder has a threaded piston end and steel head with interchangeable bronze bushings.

Circle 115 on Reader Service Card

Circle 41 on Reader Service Card



HAND HYDRAULIC PUMP

Single and Double Designs To 20,000 P. S. I.

- **Interchangeable Pistons 3/8-1/2-3/4 inch**
- **Integral Release Valve**
- **Dual Pump Unit Reservoir. 360 cu. in.**

Pressure range is 3,000 to 20,000 P.S.I. Pipe connections 1/4" N.P.T. Handle length is 18 inches. Weight is 8 to 18 pounds. Unit can be bolted or welded into position.

WILLIAM S. PINE
1637 E. 22nd St., Los Angeles 11, Calif.

4-WAY SOLENOID OPERATED AIR-VALVE only $32.50

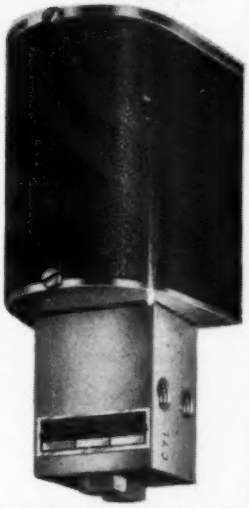
Compact sturdy construction, precision engineered for long, uninterrupted heavy duty operation.

Has small, well protected solenoid—operates small cylinders up to 3" dia. and larger cylinders where unusual speeds are not required.

Quantity and O.E.M. discounts. Write for description, discounts, etc.

IMMEDIATE DELIVERY

For Fast Operation of Cylinders up to 3" Diameter



3-WAY VALVE
Same Design
only $19.80

AUTOMATIC VALVE CO.
37427 GRAND RIVER AVE., FARMINGTON, MICH.

Circle 40 on Reader Service Card

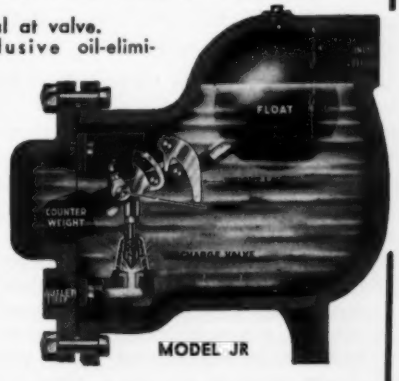
Nicholson W.O. Traps

STOP COSTLY AIR LOSS These 4 Ways

With air the most expensive pressure medium today, these 4 leak-proofing features of Nicholson air traps are proving important cost-cutters:

1) No air-wasting vent, such as is in all inverted bucket traps.
2) Large orifice keeps valve clean, preventing blow-through.
3) Positive water-seal at valve.
4) Nicholson's exclusive oil-eliminating feature prevents build-up of scum and sludge, thus solving the common problem of oil congealing on the trap mechanism and impeding or stopping its action.

Three types; pressures to 1500 lbs.



CATALOG 751

213 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.
TRAPS · VALVES · FLOATS

Circle 42 on Reader Service Card

Useful Catalogs and Bulletins

available for reference

Tube Fittings . . . New 76-page catalog of The Parker Appliance Co. combines in a single volume complete data on tube fittings and tube-to-pipe adapters, fabricating equipment, and pertinent data on engineering selection and installation. Photos, drawings, and dimensional tables are included for all shapes of the Triple-lok standard 3-piece flared fitting in brass, aluminum, steel, and stainless; the Ferulok flareless fitting in steel; precision machined pipe fittings, and tubing, tube clips, tube cutters, benders, and flaring tools. The data section includes six pages of "How to do it" photos and eight pages of valuable selection charts relating tube size to such variables as velocity and flow, differing service conditions, allowable stress, temperatures, and pressures.

Circle 121 on Reader Service Card

Air Filter-Lubricator-Regulator . . . CCA Products Division of Breco Manufacturing Company has prepared a new catalog illustrating their compressed air line equipment. This equipment includes individual plastic bowl filters, lubricators and pressure regulators. Also described are combination filter-lubricator-regulator units for the control and protection of air valves, cylinders and tools. Aftercoolers, aluminum bowl filters and dehumidifiers are also described.

Circle 122 on Reader Service Card

Hydraulic Power Units . . . Complete package units, built with single pump, double pump or combination pump are described in Catalog Section 400 offered by Rivett Lathe & Grinder, Inc. Nine models having tank capacities from 4½ to 100 gallons and power ratings of 1 to 25 hp are detailed. The catalog includes a selection table and dimension chart. A chart indicates maximum pressures at a given hp to assist you in selecting the proper power unit. Horsepower requirements at given pressures are also tabulated.

Circle 123 on Reader Service Card

Air Traps . . . Bulletin 2021, available from Armstrong Machine Works, provides data on the selection and installation of air traps to provide automatic drainage of water from compressed air intercoolers, aftercoolers, receivers, separators and drip points. It is emphasized that an air trap does not separate the moisture from compressed air, its purpose is to remove the water once formed. Methods of condensing vapor are discussed. Three different types of air traps, snap action, ball float and inverted float are described. For each type, the principle of operation, recommended use and limitations are listed. Line drawings are included to assist in the proper installation of air traps.

Circle 124 on Reader Service Card

Oil Filters . . . Capital Engineering and Manufacturing Co. offers a four page catalog which illustrates their three piece filter for oil systems. This is a mechanical type filter having a wire mesh insert held by a coupler cap and base. Tabulated sizes are 5, 10, 20, 30, 40 and 50 gpm. A full page graph is included to show the results of pressure drop tests. These are suction line, reservoir type filters.

Circle 125 on Reader Service Card

Steel Tubing . . . In an illustrated 12-page folder prepared by Avon Tube Division of Higbie Mfg. Company, the manufacture, properties and applications of Fusionweld steel tubing are presented. The tubing is particularly well suited to hydraulic systems because is can be formed to small radii with a minimum of flattening and distortion without splitting. Standard sizes from 3/16 to 5/8 are tabulated. The tubing is production pressure tested at 3500 psi.

Circle 126 on Reader Service Card

Synthetic Hydraulic Fluid . . . A 20-page booklet which describes in detail the general properties of Skydrol, a synthetic nonflammable type hydraulic fluid, and includes latest data on its evaluation in the laboratory and performance in aircraft installations, has been issued by Monsanto Chemical Company. According to comparative pump wear tests charted in the booklet, the fluid's excellent lubricity and stability extend the service life of both high-pressure and medium pressure operating pumps to an estimated 3,000 hours.

Circle 127 on Reader Service Card

Accumulators . . . Here is design and application data on both cylindrical, piston and spherical, bag type accumulators. Prepared by Pacific Division of Bendix Aviation Corporation, this 21-page catalog includes performance charts and envelope drawings.

Circle 128 on Reader Service Card

Electric Motors . . . Century Electric Company has prepared a file of descriptive data on their line of electric motors. There are individual bulletins on three types of single phase motors: repulsion start induction, capacitor and split phase; polyphase motors: squirrel cage induction, slip ring motor and synchronous motor. Each bulletin clearly shows construction and outlines and characteristics. Sizes are tabulated and performance curves are given.

Circle 129 on Reader Service Card

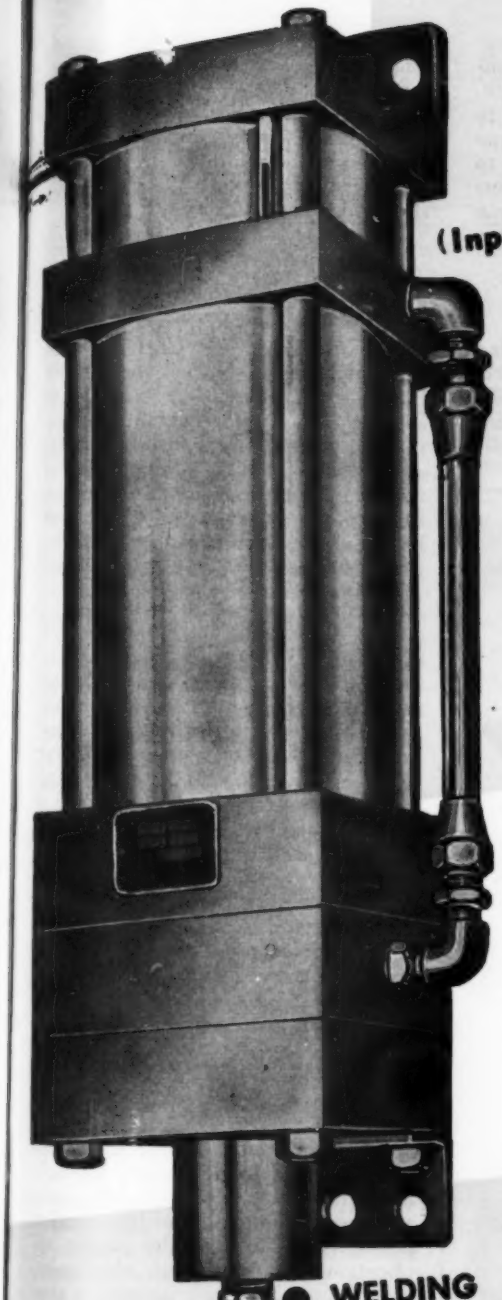
Circle 43 on Reader Service Card →

BOOST 80 PSI AIR

(Input Range: 40 to 3000 psi Air or Fluid)

TO . . . 2000 PSI HYDRAULIC PRESSURE

(Output Range: 200 to 10,000 psi Fluid)



with Miller

Fluid Pressure BOOSTERS

From ordinary plant air line pressure, Miller Boosters produce hydraulic pressures (from 200 to 10,000 psi) for driving one or more hydraulic work cylinders simultaneously at from 30 to 450 strokes per minute. Ordinarily, the booster operates one stroke for each stroke of the operated work cylinders.

Used in place of conventional type hydraulic pumps, Miller Boosters save space and weight, permit convenient portability and are easier and less costly to install, operate, and maintain. Also, they hold pressure *indefinitely —without the motion and heat generation of ordinary pump circuits.*

Used in place of air cylinders, the booster driven hydraulic work cylinder, which can do the work of an air cylinder ten times as large and heavy, saves space and weight at point of application of cylinder thrust—since the booster itself can be mounted separately—away from the hydraulic work cylinder—and either on or off the equipment or machine.

In many installations, the popular Miller Dual Pressure "Air Miser" Booster *saves up to 95% of the air* normally consumed by direct-driven air cylinders.

A wide selection of sizes, pressure ratios and mounting styles are available for the first time at low cost on a normal delivery schedule because Miller Boosters are built up from stock Miller standard cylinder parts to eliminate costly designs, patterns and castings.

Especially recommended for . . .

- WELDING
- PUNCHING
- SHEARING
- CLAMPING
- RIVETING
- CRIMPING
- PRESSING

and SIMILAR APPLICATIONS

Full Details In Miller Bulletin B-200 Sent FREE On Request

OTHER MILLER PRODUCTS INCLUDE: AIR CYLINDERS, 1½" to 20" BORES, 200 PSI OPERATION; LOW PRESSURE HYDRAULIC CYLINDERS, 1½" TO 6" BORES FOR 500 PSI OPERATION, 8" TO 14" BORES FOR 250 PSI; HIGH PRESSURE HYDRAULIC CYLINDERS, 1½" TO 12" BORES, 2000-3000 PSI OPERATION. ALL MOUNTING STYLES AVAILABLE.

Miller

MILLER MOTOR COMPANY

2008 N. HAWTHORNE, MELROSE PARK, ILL.

AIR AND HYDRAULIC CYLINDERS · ACCUMULATORS · COUNTERBALANCE CYLINDERS · BOOSTERS · AIR HOISTS

CLEVELAND — PITTSBURGH — PHILADELPHIA — DETROIT — YOUNGSTOWN — BOSTON
HARTFORD — NEW YORK CITY — DAYTON — ST. PAUL — FORT WAYNE — INDIANAPOLIS
MILWAUKEE — NASHVILLE — SEATTLE — LOS ANGELES — SAN FRANCISCO — BALTIMORE
ST. LOUIS and OTHER AREAS.

es and Service from coast to coast

Pressure Plugs . . . To help solve leakage problems in hydraulic systems, Standard Pressed Steel Co. has issued a folder describing their Dryseal pressure plugs. Line drawings show the principle of operation, and the importance of taper, form and roundness in maintaining a leak-proof thread.

Circle 130 on Reader Service Card

Flexible Metal Hose . . . Mulconroy Company offers a convenient file folder of data describing their flexible all-metal hose. Two general constructions are detailed. Sectional interlocked hose consists of multiple sections of heavy gauge steel or bronze tape, locked together to form a continuous unit, of any required length. Continuous wall hose is formed to produce a corrugated hose that is one continuous piece of metal from end to end. The catalog includes full information on couplings for flexible hose installations.

Circle 131 on Reader Service Card

Packing Adapters . . . Bronze packing adaptors for chevron type packings are described in a four page folder offered by The Gilson Company, Inc. Available in both 90 and 100 degree included angle, these male and female rings are available in sizes from 1 to 3-1/8 OD, ½ to 2½ ID. The outside and inside diameters as well as the cross-sections are the same as those discussed as desirable standards for vee type packings by the J.I.C. standards.

Circle 132 on Reader Service Card

Oil and Grease Seals . . . Complete information on The Garlock Company's Klozure oil and grease seals for bearings is available in a 100-page catalog. The catalog contains illustrations of all types of Klozures, typical applications and a complete list of sizes and part numbers. In addition, this catalog describes in detail Garlock's mechanical pressure seals for rotary shafts.

Circle 133 on Reader Service Card

Pipe Studs . . . To provide ample and accessible provision for complete cleaning of reservoirs in hydraulic systems, you will want to use a convenient means of fastening reservoir tops and panels. Donear Products Co. offers a catalog sheet which describes their new "self-seal" tank studs. Drawings show how the use of these studs simplify and reduce of cost of construction. The stud is arranged with pipe thread on one end and standard screw thread on the remainder of its length. The stud is provided with a hollow head for hex wrench.

Circle 134 on Reader Service Card

Pressure Switches . . . A 32 page manual on pressure switches has been published by Barksdale Valves to promote a better understanding of the complex problems involved in the proper applications of this vital electric-hydraulic link. The book includes a glossary of terms, a tabulation of available units based on function of and pressure or vacuum range, diagrams for circuit detailing, an electrical rating table and other important application data. It presents a comprehensive coverage of operating characteristics for diaphragm, bourdon tube, and piston type pressure actuated switches, from extreme vacuum to extreme pressure.

Circle 135 on Reader Service Card

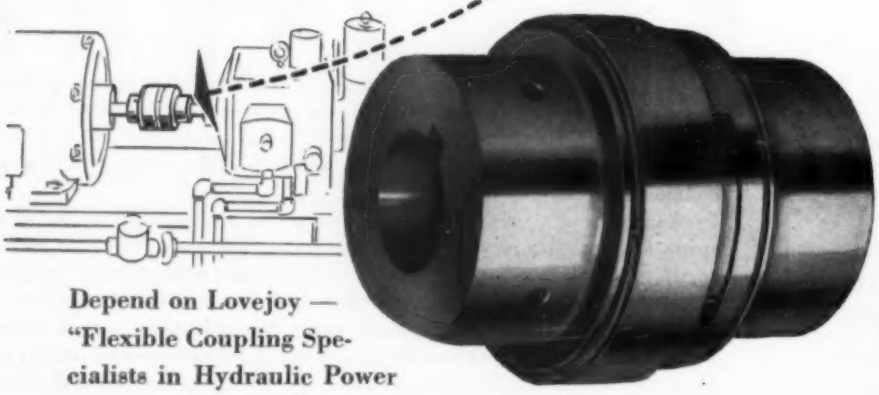
Air Cleaners . . . For positive air cleaner protection for air compressors and air cylinders you will want, for your equipment files, a specification sheet detailing the air cleaners made by Donaldson Company. An exploded view shows the construction of this simple copper mesh element for trapping dust.

Circle 136 on Reader Service Card

for this vital CONNECTING LINK.....

choose...

LOVEJOY FLEXIBLE COUPLINGS



Depend on Lovejoy — "Flexible Coupling Specialists in Hydraulic Power Units" — for the all-important link between motors and pumps. Lovejoy Flexible Couplings automatically correct mis-alignment . . . absorb vibration, surge and backlash . . . feature free-floating load cushions suspended between heavy metal jaws. No shutdowns for changing cushions — no lubrication ever needed. Cushions for every duty . . . 1/6 to 2500 H.P.

Write Now for Illustrated Catalog and Quick-Finding Selector Charts

Also Mfrs. Lovejoy Universal Joints and Lovejoy Variable Speed Transmissions

LOVEJOY FLEXIBLE COUPLING CO.
5037 W. LAKE ST. CHICAGO 44, ILLINOIS

Circle 44 on Reader Service Card

Rubber Sheet Packing . . . Raybestos-Manhattan Rubber Sheet Packings are featured in an 8-page Bulletin recently issued by the Packing Division of Raybestos-Manhattan, Inc. Included in the bulletin are illustrations, descriptions of Pure Gum Floating Stock, Neoprene, Red Rubber, Pure Gum Stock, Black Oil-Resistant, Cloth-Inserted, and Diaphragm Sheet Packings. Service recommendations are provided for each type of sheet, and the various standard thicknesses, standard packages and weights are included.

Circle 137 on Reader Service Card

Pneumatically Operated Rotary Table . . . To assist you in selecting a fast, safe rotary work table for the machining of small parts, The Bellows Company has prepared Bulletin T-85. This 16-page bulletin shows installation photographs, describes in detail all parts of both the standard 22 and 10 inch table top models. Dimensional drawings and specification data are included. This 3 color bulletin also shows wiring diagrams and electrical hook-ups to combine the rotary table with other electrically controlled air powered devices.

Circle 138 on Reader Service Card

Pressuregraph . . . Need a means of accurately measuring transient pressure phenomena? Electro Products Laboratories, Inc. has prepared a Data Sheet describing their linear stabilized pressuregraph. Specifications, installation data and operation are detailed for this precision instrument which consists of an electronic pick-up which is connected to the region where the pressure is to be studied, an associated electronic circuit and power supply, and a cathode-ray oscilloscope.

Circle 139 on Reader Service Card

Pipe Line Strainer . . . Data Manual No. 951, published by J. A. Zurn Mfg. Co. gives information on application, installation and maintenance of pipe line strainers. Factors affecting strainer size, effect of screen loading on pressure drop and space requirements are discussed.

Cirlce 140 on Reader Service Card

Vane Type Pumps...Bulletin W-485-B1 on a new heavy duty, vane type rotary pump has been announced by Worthington Pump and Machinery Corporation. These pumps are designed for circulating large volumes of non-lubricating liquids. The 4-page bulletin pictures and describes the six models of the pump in 8 sizes. They include pipe openings from 2 to 12 suction inches, and 2 to 10 discharge inches. The line includes capacities from 25 to 1,000 gpm and speeds from 850 to 210 rpm. Dimensions, nominal ratings and line drawings of the pumps are also included.

Circle 141 on Reader Service Card

Aircraft Pressurization and Temperature Control Systems . . . Want to know how a simple, typical pressurization and temperature control system for a jet fighter type aircraft operates? An illustrated folder available from Pacific Airmotive Corporation, clearly shows safety valve functions, pressure regulators and temperature valve functions.

Circle 142 on Reader Service Card

Tube Bending Machine . . . To speed your hydraulic piping and tubing installations, the Paul Machine Tool & Die Works describes their tube bending machine in an available Bulletin. Powered by air this automatic bender can handle tubing up to 2 in. diameter, 12 to 18 gauge.

Circle 143 on Reader Service Card

PLANT REPORT

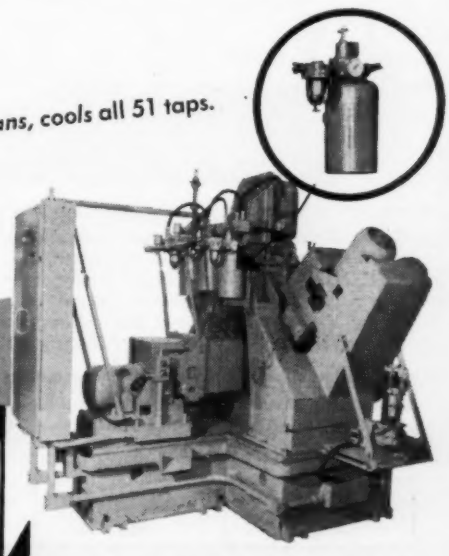
16,320 holes tapped per 8-hour shift with one machine...every one lubricated with Norgren Oil Fog. 51 taps per chucking.

INSTALLATION:
New type tapping machine built by the Snyder Tool and Engineering Co., Detroit, for use by one of the "big 3" automobile manufacturers. The machine taps 51 holes in an engine block at one chucking; taps 40 blocks an hour; replaces 4 machines in the production line.

PROBLEM:
To obtain uniform lubrication and cooling of all 51 taps and eliminate the use of a messy coolant system.

SOLUTION:
Use of a Norgren Oil Fog Lubrication System consisting of air filters, air pressure regulators, Oil-Fog Lubricators and aerosol distributors. Solenoid valves control intervals of oil-fog distribution to the taps.

RESULTS:
BETTER TAP HOLES...
...oiled air lubricates, cleans, cools all 51 taps.
LESS TAP BREAKAGE
LONGER TAP LIFE
NO MESSY COOLANT SYSTEM



•LUBRICATORS
•FILTERS
•REGULATORS
•VALVES
•HOSE ASSEMBLIES

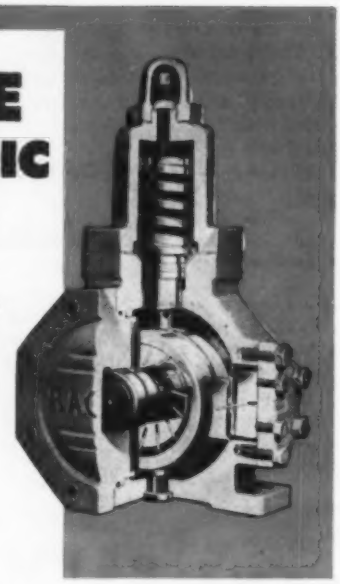
Norgren
25 YEARS OF HELPING TO MAKE AIR POWER SERVE INDUSTRY BETTER

C. A. NORGREN CO.
3402 So. Elati—Englewood, Colorado
(Suburb of Denver)
Gentlemen: Please send me your free Norgren Blueprint No. 114, giving complete data on above lubrication system.
NAME_____
ADDRESS_____
COMPANY_____

Circle 45 on Reader Service Card

RACINE HYDRAULIC PUMPS

Simplify your Circuit



Less valves and controls in a circuit provide easier installation and lower initial costs.

RACINE "Variable Volume" Pumps eliminate relief valves and extra piping. They reduce horsepower requirements and avoid excessive heat losses. Over-all cost of motor and reservoir is usually reduced. Efficiency is high because RACINE Pumps "put all of the oil to work."

A wide range of governor controls provide pumping action at the proper pressure and volume to handle any given job most effectively. These interchangeable governors are an exclusive RACINE feature.

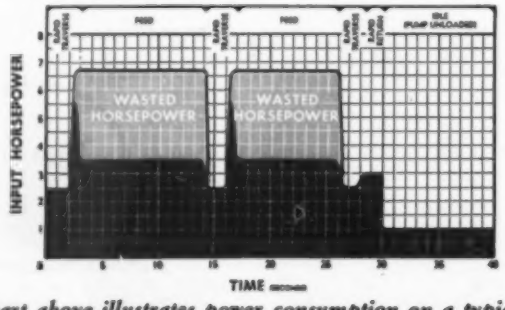


Chart above illustrates power consumption on a typical machine tool. Black area is power used with a No. 2 RACINE "Variable Volume" pump controlled by a pressure compensated feed valve. Area in color is power wasted by a constant volume pump, bypassing most of its volume through a relief valve during the feeding cycle.

OTHER RACINE HYDRAULIC PRODUCTS

Four-Way Valves

Pressure Boosters

Pump & Reservoir Units

Write for new 3-color Catalog P-10-D covering RACINE's complete line of "Variable Volume" Pumps, Valves and Pressure Boosters.

RACINE

TOOL AND MACHINE CO.

1774 State Street, RACINE, WISCONSIN, U. S. A.

Porous Bronze Bearings . . . High among the applications of bearing bronze is use in hydraulic pumps. Catalog P-2, prepared by Boston Gear Works, contains 32 pages of dimensional and application data on bearing bronze. Details on plain cylindrical flange type and thrust bearings are given along with information on cored bars, plates and solid bars. Graphs plot curves showing permissible bearing loads as a function of shaft speed and diameter. Tolerances for press fit assemblies are also plotted.

Circle 144 on Reader Service Card

Swivel Joints . . . Selection of swivel joints offers some unusual design possibilities where it may be advantageous to have moving pipes. Flexo joints are described in Flexo Supply Company's bulletin. These joints make possible the use of rigid pipe for flexible installations. The illustrated design shows full pipe area in all directions through 360 degrees. An exploded view of the coupling shows the simplicity of the four parts which make up the assembly. Dimensional data for four styles are charted.

Circle 145 on Reader Service Card

Motor Controls . . . Arrow-Hart Industrial Control Division has issued an 8-page Bulletin describing their Explo-Safe motor controls. The small size and weight as compared to other across-the-line solenoid type motor starters is emphasized. Diagrams show the straight-thru wiring which simplifies instaliation and maintenance. Sizes of these across-the-line, reversing and two-speed controls are tabulated.

Circle 146 on Reader Service Card

Eliminating Hydraulic Shock . . . A method of eliminating severe shock and vibration of hydraulically operated bucket loaders, power shovels, and other tracked and rubber tired equipment is described in a new Bulletin 700 by Greer Hydraulics, Inc. Since hydraulic fluid is practically incompressible, the vehicle itself must absorb impacts caused when the loaded bucket is moved or stopped suddenly, when the load is suddenly added or released, and when the loaded equipment moves over rough terrain. The booklet shows how an accumulator will absorb shock, increase component life, relieve the equipment of structural fatigue, and increase the production of the machine by adding to the comfort of the operator.

Circle 147 on Reader Service Card

Hydraulic Valves . . . Designed for the control of air, oil or water, control valves made by Versa Products Company are described in Folder No. 11. Application and operation of both 3- and 4-way valves are detailed. The valves are available with pilot, cam, foot or hand actuation.

Circle 148 on Reader Service Card

Pressure Gauges . . . Here's a Bulletin Sheet describing standard and special hydraulic pressure gauges as made by Marshalltown Manufacturing Company. Construction of these Bourdon type gages is illustrated with cutaway photos. Sizes are tabulated. Standard dials from 1000 to 30,000 psi are available. Special radial dial and twin pointer hydraulic gauges are described.

Circle 149 on Reader Service Card

Oil Filters . . . Air-Maze Corporation has prepared a 12-page Catalog describing their mechanical type filters for hydraulic systems. These filters are available for large or small capacities, low or high pressure, with or without built-in relief valve. A cutaway view shows the individual filter discs and spacers which are stacked over a perforated center tube and assembled in a container.

Circle 150 on Reader Service Card

Limit Switches . . . One of the most versatile components in the control of hydraulically powered machine members is the limit switch. National Acme Company has prepared a complete file folder, Bulletin EM-50, which details their standard switches. Designed for machine tool applications, the four basic series: standard, short travel, neutral position and push lever are detailed. Current ratings, operating lever travel, dimensional data and wiring diagrams are presented. Sixteen styles of operating levers are illustrated and dimensioned.

Circle 151 on Reader Service Card

Sludge and Gum Solvent . . . If sludge in hydraulic systems is cutting down hours of useful machine production and equipment life, Swan-Finch Oil Corporation's folder describing Hydro-Solv "A" will be important to you. The folder outlines the effects of sludge formation in hydraulic systems; describes the composition of their sludge and gum solvent, and presents a recommended procedure for using the solvent.

Circle 152 on Reader Service Card

STOP **DOWN TIME ON AIR-OPERATED EQUIPMENT With the HANNIFIN "AIR WARDEN"**

High production schedules *DEMAND* continuous performance from air-operated equipment. So Hannifin developed the "Air Warden" as the finest protection possible.

One complete "Air Warden" unit FILTERS AIR — REGULATES PRESSURE — LUBRICATES —*Simultaneously!*

GET ALL THE DETAILS ON HANNIFIN'S MONEY-SAVING "AIR WARDEN"!
Components sold singly or in any combination. Write for literature.

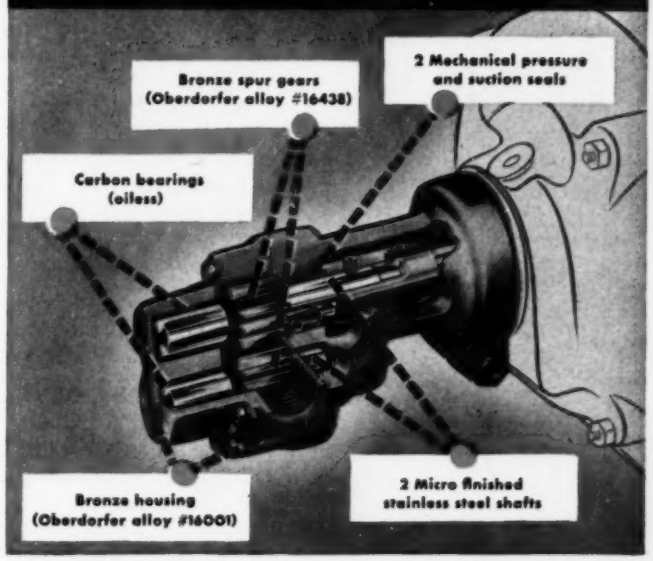
HANNIFIN

Hannifin Corporation, 1155 S. Kilbourn Ave., Chicago 24, Illinois

Circle 47 on Reader Service Card

For liquid transfer where space is at a premium . . .

The New Series II BRONZE OBERDORFER INTERNATIONAL Close-Coupled ROTARY GEAR PUMPS


Bronze spur gears (Oberdorfer alloy #16438)
2 Mechanical pressure and suction seals
Carbon bearings (oilless)
Bronze housing (Oberdorfer alloy #16001)
2 Micro finished stainless steel shafts

These two motor driven pumps have all-bronze housing and gears, oilless carbon bearings, micro-finished stainless steel shafts (± 25/100,000 of an inch) and are powered by heavy-duty ⅓ h.p. motors* equipped with thermal overload protection.

They are intended to be used wherever a liquid has to be moved from one location to another in quantities up to 240 gallons per hour at pressures from 0 to 100 lbs. per square inch.

They are adaptable for a wide variety of industrial and chemical applications where a corrosion-resistant pump is required and space is limited. Their all-bronze body and gears permit use with most liquids.

*110 volt AC, Motor standard but specially machined for pump mounting.

Capacity Tables Gallons per hour—1,725 R.P.M.—lbs. sq. in

Pressure	Pump No. 1½ CCC	Pump No. 2 CCC
0 lbs.	120 gal.	240 gal.
25 lbs.	110 gal.	220 gal.
50 lbs.	100 gal.	190 gal.
75 lbs.	95 gal.	170 gal.
100 lbs.	90 gal.	——

Dimensions and Prices (Pump only)

Pump No.	Height	Width	Length	Price
No. 1½CCC	2⅞"	2 11/16"	4¾"	$20.00
No. 2CCC	3 11/16"	2⅜"	4⅞"	22.50

All Prices F.O.B. Syracuse

Complete units with ⅓ H.P. 110 volt AC thermal overload motors . . . prices on request.

See our catalog in Sweet's File for Product Designers

DEPT.-522 INDUSTRIAL PUMP DIVISION Oberdorfer Foundries, Inc. Syracuse, N. Y.

Circle 48 on Reader Service Card

Recently Developed

3-WAY
FULL AREA, PACKLESS
SOLENOID VALVES

SIZES:
1, 1¼, 1½
and 2 inches

We recommend this valve for controlling equipment where pressure must be alternately applied and exhausted as, for example, with diaphragm motor valves, air or hydraulic cylinders, etc. Classed as Bulletin 8331 ASCO Valves, here are a few specifications: pipe sizes 1, 1¼, 1½ and 2 inches. Maximum pressure 125 to 250 pounds; minimum pressure 10 to 20 pounds. Suitable for handling air, water, gas, oil and other non-corrosive gases or liquids up to 180°F.

Since the automatic control of any alternating application and release of pressure is so important for efficient operation, we suggest that you bring your problems to the attention of our engineers. Designing just such controls has been our business for nearly forty years. If Bulletin 8331 Valve doesn't seem to fit your requirements, we have many other types—all in the broad class of automatic control units. Or, if necessary, we shall be glad to design a new type of valve to fit your special needs.

ASCO Solenoid VALVES

If you have recurrent and varying needs for automatic control valves, you should have our General Valve Catalog No. 23.

When in need of Automatic Transfer Switches, Remote Control Switches, Contactors, Relays, and Specialized Electromagnetic Controls, come to us.

Automatic Switch Co.
385-H LAKESIDE AVENUE • ORANGE, NEW JERSEY

Circle 49 on Reader Service Card

Pressure Switch Control

Concluded from page 30

are used to meet the outer limits of test acceptability. The brake light switch must operate between 60 psi and 110 psi. If the part being tested makes contact within proper limits pressure switch 4 closes. A green light appears to indicate the part is good.

If the part should require a closing pressure greater than 110 psi, pressure switch 5 will close to operate auburn colored lights giving a visual indication of a high reading. If the part makes contact before the 60 psi low pressure limits, pressure switch 4 will not close, and red lights will glow.

Characteristics of the switches and hydraulic system make it necessary to arbitrarily set pressure switch settings at pressures which will give accurate results when the tested switches are checked against a master switch.

To fulfill the amperage requirement on the switch a suitable transformer and load is placed in the electrical circuit in series with the brake switch. When the switch makes contact an equivalent load of two bulbs on a 6 volt battery circuit is applied.

Achieving the stipulated production rate is of course a result of overall design. Actual time study has shown a sustained production rate of 10 parts per minute.

Torque Control For Screw Setter

Concluded from page 40

Speeding up cycle time means more oil must be delivered to the cylinders or the cylinders must be changed completely. Changing the cylinders would not be practical from either a cost or design standpoint. The logical approach was to pick a pump of higher capacity and then see what piping and valve changes must be made to handle the increased volume at a safe speed.

The work sheet in Figure 3 shows our design approach. About 12 seconds had to be saved on the time for transferring and the time for raising the spindles. Since lowering of spindles and transfer occur together, we did not include in the chart time for lowering the spindles. Another factor to keep our computations on low side (below actual time savings) is the stroke of the head cylinders. The chart uses full cylinder stroke 2⅜ inches. Actually only a fraction of the full stroke is used. Also the chart uses all four head cylinders operating together, while in the complete cycle, head 2 operates only once while head 1 operates 4 times.

The original machine uses a 1.4 gpm pump. Computations are made for the next two commercial sizes of this pump so that the cost of increasing pump size is

only for a new ring for the present pump. We come out with a savings of 11.18 seconds by going to a 3.1 gpm pump. Because we purposely computed on the low side, the savings are considerably greater, so we are assured of at least 25 percent boost in output.

To handle the increased flow, valve and tubing sizes were stepped up to keep fluid velocity at a safe 10 fps and to keep operating pressure (500 psi) and the temperature (105 degrees F) at present optimum levels.

"for low cost maintenance"

Concluded from page 35

for the 3-way valve is supplied by a gear pump built into the variable delivery pump housing.

Designers of hydraulic systems in 1952 may well ask why two pumps and motors are used in the main system. Why not one variable delivery pump driving a constant delivery motor? The answer of course is that while today the designer has available individual pumps and motors capable of developing 40 hp under severe operating conditions, designers in 1933 were not so fortunate and had to use multiple setups.

An important requirement of the Chicago Carton drive is proper synchronization of the cut-off with the main drive. To accomplish this, the pump powering the fluid motor of the cut-off drive is belt driven from the main drive so that changes in the processing speed automatically increase or decrease the cut-off drive speed to produce constant cut-off lengths. To further assist in maintaining an accuracy of plus or minus 3/32 inch in sheet length when operating at paper speeds up to 600 fpm as well as during the period of acceleration and deceleration, a small constant delivery pump and a special hydraulic compensating mechanism is incorporated in the cut-off drive circuit.

This slip compensator is of the injection type and was made specifically for this application. It compensates for the small change in pump slip caused when speed is changed during the processing period. It does not provide complete compensation for the variations in slip caused by high speed acceleration and deceleration.

Over a number of years, Chicago Carton has had in operation along with the hydraulic drives, machines powered by cone belt drives and variable pitch pulley drive. Spacewise the hydraulic system requires no more than a third of the cubic space required by the variable pitch pulley drive. By comparison, the hydraulic system has proved to be cleaner, more efficient and simpler to maintain.

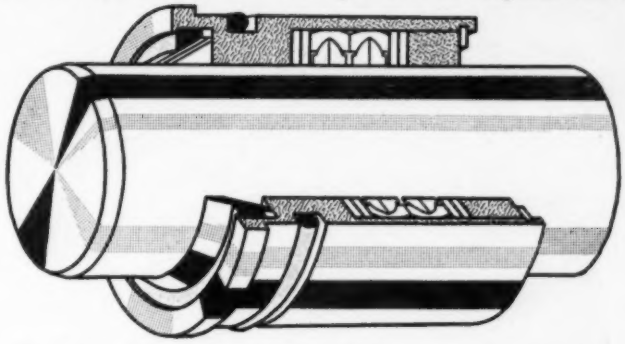
For sixteen years this hydraulic drive has filled production expectations, kept abreast of other equipment on the market, required infrequent maintenance and has produced exceptionally high returns on the original low investment.

Circle 50 on Reader Service Card

SPECIFY the NEW

MONOPAK-CARTRIDGE PACKING UNIT!

For Pneumatic and Hydraulic Cylinders



Combines all necessary Packings, Bearings and Rod Wipers into One Compact Unit.

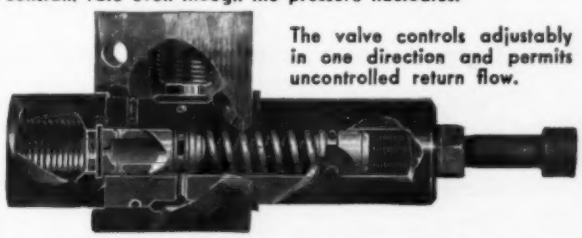
Can be installed or replaced by totally inexperienced mechanics within a few seconds.

Write for Literature

HYDRAULIC ACCESSORIES CO.
439 E. Fort St. • Detroit 26, Mich.

An adjustable
FLOW REGULATOR

This newly perfected adjustable Flow Regulator holds at a constant rate even though the pressure fluctuates.



The valve controls adjustably in one direction and permits uncontrolled return flow.

The spring back piston in the housing is mounted in front of the adjustable screw. It carries a calibrated orifice; operates axially on change in inlet pressure so as to increase the throttling action.

Four sizes, 1/4, 3/8, 1/2, and 3/4 inch. Overall length, 4 1/2 to 7 1/2 inches. Adjustable over a 50% flow range. Maximum pressure is 3000 pounds.

Write for illustrated circular.

West Coast: H. E. Webb
918 North Kenilworth Avenue Glendale, California

WATERMAN ENGINEERING Company
725 CUSTER AVENUE • EVANSTON, ILLINOIS

Circle 51 on Reader Service Card

Hanna® Cylinder Control Valves

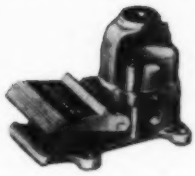
Trademark of Quality

...put exacting control of cylinder power at your finger tips

Hanna Unitite Valves are designed and built to give long, trouble-free service as hand-operated cylinder control valves. They are quick-acting, packless and permanently tight. Except for periodic lubrication, they require no maintenance: (Laboratory tests have shown maintenance-free operation for 10 to 15 million cycles!)

They may be used for 3-way or 4-way operation for air, oil or water pressures up to 250 p.s.i., and are available in three mounting styles—standard, column and manifold.

Foot Operated



Hanna Foot-Operated Valves are available in single and double pedal models for operation up to 250 p.s.i., for use with air or hydraulic cylinders.

Electric Operated

Hanna Solenoid Valves are available in single or double solenoid models. Momentary contact . . . High speed . . . Specially suited to automatic operation or remote control.

Speed Control

Hanna Flo-Set Valves have micrometer graduations to assure exacting speed control. They are available in ¼", ⅜" and ½" sizes for air, oil or water to 250 p.s.i.

Send for Catalog

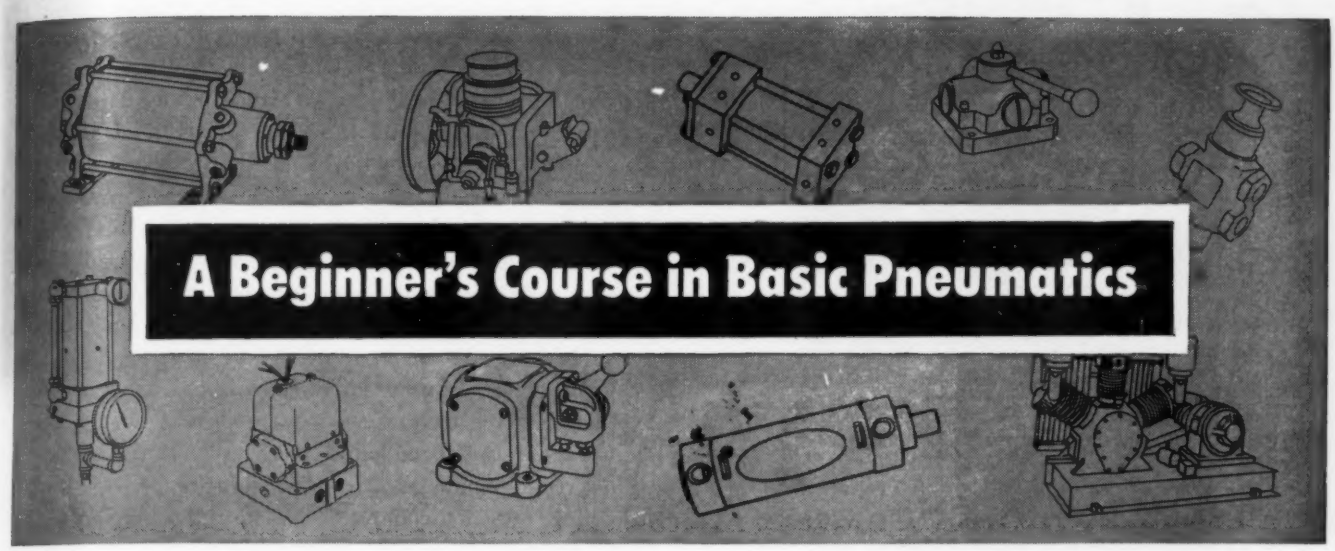
New Hanna Valve Catalog No. 254 gives full information on the complete line of Hanna Valves for all circuit requirements.

Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

1741 Elston Avenue, Chicago 22, Illinois

Circle 52 on Reader Service Card



A Beginner's Course in Basic Pneumatics

Section I Air Properties and Characteristics
Introduction
Part I

COMPRESSED air is one of the most widely used sources of power. It is used for literally thousands of applications from pilot operation of valves to the Bessemer process of making steel and from delicate laboratory instruments to the primary power source for actuating major surfaces of giant airplanes. There is hardly a manufacturing or a processing plant in the United States that does not use compressed air for a variety of operations.

Compressed air is used on the farm for such simple jobs as spraying, silo filling and milking; it is used to hasten the removal of earth and rock for roads, mines, tunnels and new buildings; to speed the building of all structural steel assemblies—commercial and public buildings, bridges, ships and industrial equipment of all types. Compressed air power works above and below the earth; on the earth it is perhaps the most universal of all power sources.

A bare enumeration of the common uses of compressed air, cylinders, valves, tools and accessories will indicate both how widespread and essential the uses of air in American industry have become. New uses for air power are constantly being made; successful applications continually stimulate the ever increasing range and variety of compressed air as a power and control medium, as a convenience and safety factor and as an aid to increased production and lowered unit of work cost.

Compressed air may be used directly for work performance; it may be used to operate motors, chucks, cylinders or tools; it may be controlled through valves and accessory units to perform a great variety of mechanical movements; it may be used in combination with oil control units to achieve economical high pressures and accurate work cycles; it may be basic in many important instruments.

Direct Use of Compressed Air

Compressed air is used in industry directly as power to perform work. It is widely used for agitation and aeration of fluids from sewage sludges to inflammable mixtures in processing operations. Compressed air is used for lifting oil and gas in oil fields, displacing and transferring oil in a number of industries; it is employed to move pulverized coal in power plants. Compressed air is universally used in the manufacturing industries for cavity and surface cleaning and part ejection for presses.

Pneumatic power is used for inflating, testing and inspection of rubber parts such as tire tubes and industrial rubber goods. It is used as an auxiliary or secondary cooling agent for metalizing of worn parts. An important use is in the steel industry where huge quantities of low pressure air are used for aerating metal in the Bessemer process.

Air Motors, Chucks and Cylinders

However, compressed air as a power source is used much more widely and often more efficiently in a mechanical device designed to utilize the stored energy of compressed air to perform useful work. Air motors, chucks and cylinders are among the most widely used units.

Fig. 1. Air operated riveter in use fabricating an air wing structure member.

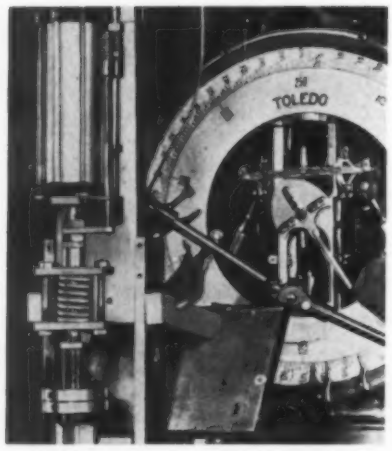


Fig. 2. An air cylinder in use in spring testing setup.

Fig. 3. A compression riveter being used to form countersunk rivet head dimples in aluminum sheet.

Air motors, as the term will be used, is understood to be a rotary air motor. The cylinder, of course, is a linear air motor, while the air chuck is an adaptation of the air motor for the quick opening and closing of jaws; chucks are commonly employed for clamping operations. Air motors (rotary) are used for work positioning, rotating tools, operating hoists, for pumping water or other fluids, to operate steam tables and as a power means for tube cleaning (metal, glass, including neon tubes, etc.). Air motors are also used for brakes and braking systems (railways, buses, etc.).

Air chucks are used on lathes, milling machines and other machine tools and production equipment to reduce loading and unloading time, increase production and reduce spoilage. Air vises, positioning jigs and cylinder operated clamps, also used on production machines, are in the same category.

Air cylinders, the use of which is extremely common on all types of industrial machines, are used wherever linear power movement is required. A review of the bore sizes, mounting types, effective working pressure ranges and stroke lengths offered by leading cylinder manufacturers reveals that a standard or special cylinder is made for practically every linear movement on industrial machines.

Pneumatic Tools

Perhaps the most common use of compressed air throughout industry is as a power source for pneumatic tools. Such familiar units as drills, squeeze riveters, weld and rust scale chippers, clamps, chipping and breaking hammers, sharpening and cutting tools, sand blasters, tube cleaners, caulking and grease guns, nut and bolt tighteners or runners, sorting and aligning devices, tampers, pullers or extractors, reamers, punches, vibrators (move, grade or sift solid materials), grinding, polishing, sanding and buffing tools, automatic feed devices and safety interlocks all come under this general classification. The term is commonly used to designate a single, portable, high speed tool, usually hand operated.

Pneumatic Valves and Accessories

Valves are devices for the control of direction, flow and pressure of compressed air to achieve a desired delivery of air to a work unit. Timing and safety for accurate cycling may be, and frequently is, a function of automatic control. Through a large number of standard pneumatic valves (see APPLIED HYDRAULICS Directory, January 1952), the designer has a wide choice of approaches for arranging the work cycle. In addition, air valve manufacturers can and do build modified or special valves to meet special conditions.

Pneumatic accessories are a rather general term. We use it here for an assembled integral device including valves and permanently fixed work motor or cylinder designed to achieve a given work movement. Such units as jacks, shock absorbers, press feeds and control units, arbor presses, automatic index plates, die cushions, re-

Circle 55 on Reader Service Card

Now! CONTROL AIR OPERATIONS ELECTRICALLY!

PUSH BUTTON OR LIMIT SWITCH CONTROL FOR

- AIR CYLINDERS
- AIR CIRCUITS
- AIR-OPERATED PRESSES

Quiet . . . dependable . . . economical. Unlimited range of applications. Ideal for remote control or for building into equipment. Two types. Ask for Hannifin recommendations.

GET BULLETIN 230

Contains specifications, dimension table, wiring diagrams and other useful data.

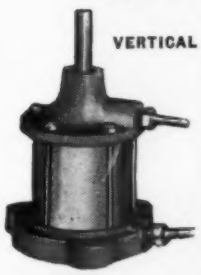
HANNIFIN

Hannifin Corporation · 1155 S. Kilbourn Ave., Chicago 24, Ill.

AIR-MITE Air Cylinders

Single Acting

Double Acting

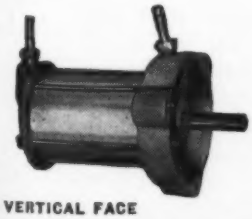


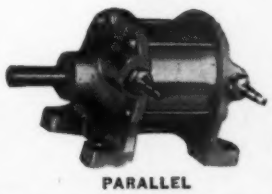
Worth Their Weight in GOLDen Man-Hours

Save time, spoilage, cost . . . speed production . . . reduce fatigue . . . on all drilling, reaming, tapping and processing jobs. Available in 1", 1½", 2¼", 3", 4" and 5" diameters; stroke length optional. Single or double action; all mountings.

Write for complete catalog of Air Cylinders and Air Arbor Presses.

AIR-MITE 4417-A West Carroll Ave. Chicago 24, Illinois





Circle 56 on Reader Service Card

Circle 64 on Reader Service Card

LYNAIR

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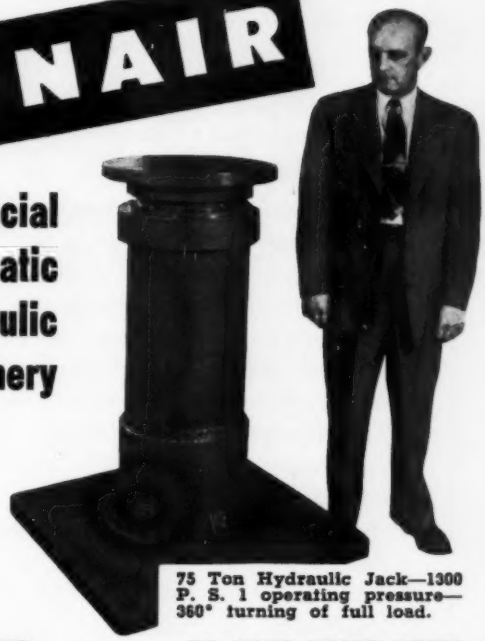

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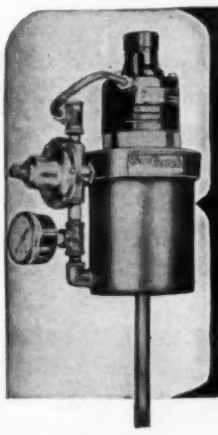

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Many applications include positioning electrical components, variable speed drives, rubber pinch valves, etc. Available in 4", 6" and 8" diameters with 3" and 4" stem travels. Furnished complete with cushion-loading regulator and gauge, fully piped, ready for installation.

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Advantages of Compressed Air for Industrial Power and Control Applications

1. *Air is universally available*
2. *Compressed air can be remotely stored for instantaneous use*
3. *A small prime mover and compressor can be used for intermittent air power service*
4. *Units of a working pneumatic circuit are relatively few and simple*
5. *Highly efficient components are readily available*
6. *Transmission lines are relatively small, usually of inexpensive, non-critical materials; no return lines are required*
7. *Operation is practically independent of temperature*
8. *There is no fire hazard; the system is clean*
9. *Application possibilities are extremely flexible, e.g. air-hydraulic combinations; air, hydraulic or electrical control of air circuits; air circuits are equally applicable to original equipment, redesigned or retooled machines.*

Disadvantages of Compressed Air for Industrial Power and Control Applications

1. *Compressed air is not cheap as a power medium; a compressed air system has an inherently low efficiency*
2. *Much air is wasted by inefficient controls and carelessness of operators*
3. *Large leakages are often encountered through poorly installed and maintained transmissions systems*
4. *The compressibility or "springiness" of air may be a serious handicap in a system unless the designer understands and puts this characteristic to work for him.*

placement clutches, leveling devices, automatic drill press feeds are but a few of the host of pneumatic accessories available.

The use of pneumatic assemblies for spraying is another very broad field of applications. Paint, greases, oils and varnishes are commonly pneumatically sprayed. Glazes for ceramics, metal parts and containers; water in sprinkler systems; cleaning solutions, insecticides, orchard and garden protective sprays are efficiently distributed by compressed air. The spray coating of protective film for finished cutting tool surfaces was a rather common practice during the last war. An important part of the "cocoon" process used by the Navy to "mothball" ships was done by compressed air.

The Air-Hydraulic Unit

The air-hydraulic unit must be mentioned here. While not strictly an accessory, since it is an integral power unit, it is important because its basic design is one that utilizes the power of air and the control advantages of oil to perform a standard approach-work, dwell-retract machine cycle more efficiently than either air or oil power could do it alone. Small, compact units, designed for use on standard drill heads as well as heavier units, adaptable for heavy, continuous duty service, are available.

Fig. 4. Close up of clevis mounted air cylinders used to operate a tension coiler for light gauge steel. The cylinders operate the crank which turns the coil. All photos courtesy Compressed Air and Gas Institute.

Boosters

The steadily growing use of the air-oil booster merits individual mention. The booster, essentially a device for utilizing an inlet air pressure for an outlet oil pressure at a higher ratio fixed by the differential of respective piston areas, has definite advantages, such as elimination of high pressure pumps and minimization of high pressure transmission lines. Boosters of several types and pressure ratios make their use practical.

Pneumatic Controllers

The pneumatically controlled instrument field is a large one—one which we will only point out. In some of the chemical processing industries, the papermaking and the textile industries, pneumatic controllers are basic tools, long used. In other fields, like machine tools, multiple operation production machines, single purpose special machines, food packaging equipment standard pneumatic controllers are gaining.

It is difficult to find a reasonably modern plant in any industry anywhere that does not have a representative group of pneumatic equipment in daily operation. While the compressed air industry is by no means new, the rapid increase of pneumatic applications in the past five years has been the result of the growing acceptance of pneumatic power and control components by the production industries and the parallel development by the designers, makers and suppliers of pneumatic equipment.

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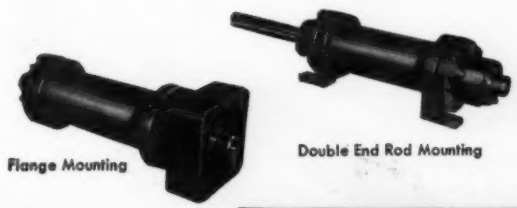

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By A. R. Morse

How To Keep Oil Systems Clean

Part I of a two part article on Hydraulic Maintenance

RECORDS show that machine downtime in the injection molding industry is about 50% due to troubles associated with the hydraulic system, about 35% associated with the heating cylinder and 15% with electrical failures of various types.

With recent growth in the number of piston type pumps in use and the clear-cut trend to full hydraulic clamp on large machines, downtime on the cost basis is about as follows: 50% of cost of downtime, heating cylinders; 45%, hydraulic maintenance and 5%, electrical.

The relative seriousness, therefore, of hydraulic downtime with piston type as opposed to vane type pumps, of itself, justifies any precautionary measures that can be taken.

Selection of Oil and Filter Medium

As a general rule a "Light" hydraulic oil is ordered for vane type and a "Medium", or "Medium Heavy" grade for piston type pumps. When either type of machine runs consistently hotter than normal, there is often a saving in downtime if one grade heavier oil is used than normally specified. Some molders do this as a regular practice to reduce leaks and gain machine speed, and because of the type of service demanded of injection oil, there is no harm therein—in fact it would probably be "officially" recommended if injection hydraulics were ever singled out for the special study deserved by the use-severity of the typical circuit.

The question of additives and inhibitors used in the various oils to suppress frothing, reduce oxidation, counteract acid and wax formation, and improve the viscosity, invariably arises when the use of filters to reclaim and maintain oil quality is proposed for the injection molder. Oils with additives are considerably more expensive than the untreated oils successfully used for years in the injection industry, so naturally the molder is concerned when the oil salesman implies filters may remove the additives.

Exhaustive tests run in injection plants all over the country prove that the earth type filter will correct the oil for acidity, remove moisture and deleterious oxidation products, and leave the oil in condition "as good as new". Cellulose type, mechanical disc type, or other filters will remove physical dirt from the oil and it is not very often that physical dirt particles cause serious downtime in injection plants, except in new machines,

A. R. Morse is sales engineer, Injection Molders Supply Co., Cleveland, Ohio.

A. R. Morse has been active in the injection molding field for over eleven years. Based on his experience with hydraulic applications in this field he has prepared a two part article describing some of the equipment and procedures which are currently being successfully applied to reduce machine downtime in his field. Because more than 70 percent of all service calls on hydraulic equipment are attributed to improper selection and care of the oil, Mr Morse emphasizes methods for keeping oil "in as good as new" condition.

In a subsequent issue, Part 2 will discuss oil cooling methods and the prevention of tubing failures. Although based on experience with plastic molding machines, the suggestions made here can readily be applied to all oil hydraulic machines.

On this injection molding machine an earth type filter, with built-in relief valve, filters oil which is bypassed from the oil cooler. Filtered oil returns to the tank. The pressure gage on the front of the filter shows when the cartridge needs changing.

or where dirty oil barrels are accidentally used, as does frequently happen.

The chief argument applied against the earth type filter is that it removes the additives (oxidation inhibitors, anti-rust compounds, etc., etc.) from modern oils. Actually tests prove that when a new cartridge is installed in an earth-type filter, it will remove a small percentage of certain types of additives only, and it removes these only until the cartridge is saturated, whereupon all the additives present in the oil before filtering are found in the recovered oil after filtering, except for the miniscule percent removed in originally saturating the new cartridge.

Integral and Portable Filters

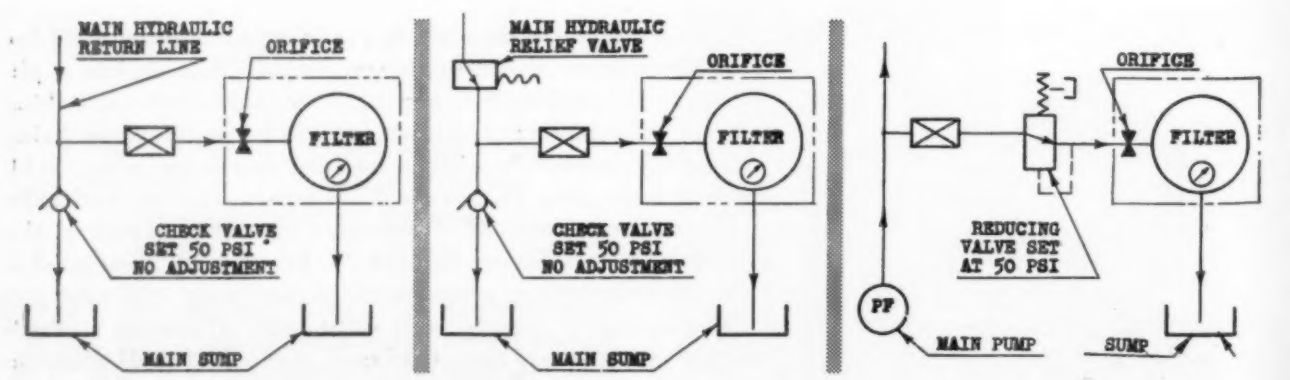
There are two general types of filters which are suitable for use in the average molding plant—the integral and the portable.

Integral filters must have certain features to be safely installed in the injection circuit. They should be of heavy, all-steel, explosion proof construction. They should have a built-in preferably internal relief valve so that in the event of any unforeseen obstruction the filter will not burst. Furthermore, they should have a very large earth capacity to reduce the frequency of maintenance, and to handle a relatively large volume of oil without restriction, because small filters are quickly rendered useless unless constantly attended—an unlikely eventuality in the average injection plant.

Integral filters are easily piped into any injection machine circuit. If installed in a low pressure line, no restriction or pressure reducer is necessary. If bled into a high pressure line, the intake should have preferably a pressure reducer installed ahead of the filter, or else a needle valve to permit the volume of oil flowing to the filter to be controlled. The return line from the filter to the machine oil reservoir should have a sight glass to allow the clean oil flow to be observed. Most filters have pressure gauges on them for safety reasons and to show when the cartridge needs changing. The typical injection machine filter of the integral type needs a replacement cartridge only about twice a year in normal use.

The second kind of filter, (and perhaps the more suitable of the two types if a choice has to be made) is the portable model, dolly mounted, with draw bar. Heaters on the portable filter are sometimes suggested where cold oil is to be handled with maximum filter efficiency. For general injection plant use however, heaters are not absolutely essential for two reasons. The

Three typical piping arrangements for connecting bypass filters in a system



grade of oil to be handled is light, and if the filter is piped directly into the oil reservoir with the injection machine in operation (as is recommended) the oil is already at the optimum filtering temperature.

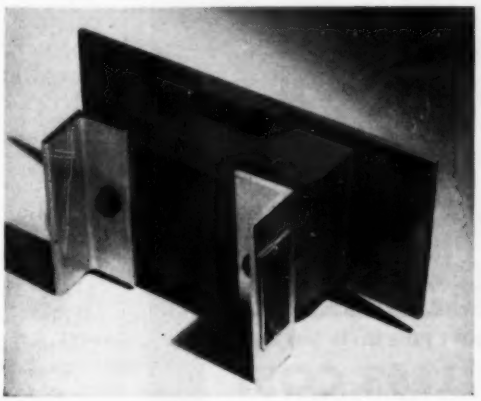
A portable filter can handle any number of injection machines, so that if four or more machines are installed in a plant the original cost of integral filters exceeds that of a portable unit. Furthermore, portable units (with intake traps of the mechanical filter type as should be provided to lengthen cartridge life) can be used to salvage hydraulic spillage by connecting them direct to decanting tanks. This salvage operation is generally carried out just before a cartridge change. If moisture is present, and if the filter does not have heaters, capacity of the filter will be slightly reduced in gallons per hour, but operation is not interfered with, and the units may be left unattended. Cartridge life is a variable, but averages about 7-10 machines, operating for 24-48 hours on each machine. If excess moisture is present, filter capacity is sharply reduced and pressure increases abruptly. By allowing the filter to stand 8 hours, and then withdrawing the accumulated moisture from the bottom drain before commencing filtering again, as much as 2-5% moisture may be removed from injection machine oils, a vital factor in machine life. This moisture spontaneously appears from sweating of tanks and coolers, and seems unavoidable. Cellulosic and mechanical filters will not handle it, and it tends to unite with sulfuric acid residues in the oil and to plate out on internal surfaces in the form of a brown scale.

Oil Tank Magnet

There is in the injection machine circuit a certain amount of finely divided iron and magnetic oxide particles. This seems to be true even if filters are used, and appears to come from wear of parts, oxidation, and rust. The particles settle somewhat in the tanks, with the top layers being swept back into the circuit, particularly when the sediment is agitated by relief valve discharge into the oil tank. To combat this condition, large surface magnet can be placed in the bottom of the oil tank where the iron particles settle and lurk out of reach of filters. The plates pick up a teaspoon of particles from almost any injection machine, and require no maintenance except wiping off about once a year to remove accumulated particles. Removal of these particles definitely contributes to longer pump life and less wear on valves and other internally lubricated parts.

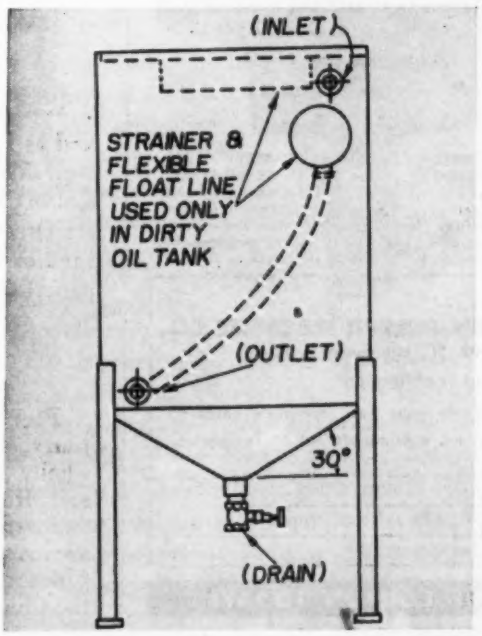
Oil Storage And Oil Salvage

The chief hydraulic problem in the injection plant is keeping the hydraulic oil clean and pure. To eliminate contaminated oil drums which frequently ruin oil being taken from a machine during repairs, special clean oil storage and decanting tanks have been designed. A screen type lid is used in the receiving opening of the tank to remove particles of plastic and other material which is found in spillage. A cone type sump is provided to act as a heavy sediment trap, and is equipped with a valve to allow water and settlings to be gently drawn off without disturbing the salvageable oil. When makeshift decanting is performed in ordinary drums, some contamination always results because of difficulty of separating settlings and oil. To allow only the cleanest oil to be removed from the decanter, a special float type outlet has been designed to carry the actual outlet at the top of the oil level, permitting withdrawal only of the top undisturbed layer of oil. The clean oil tank is similar in external appearance to the decanting tank so a neat looking installation of the two units can be made.



A large surface magnet placed in the bottom of the oil tank removes oil particles from the oil to prevent damage to the pump and valves.

Side elevation of an oil decanting tank. Water and impurities are drained off at the bottom. Clean oil at the top of the tank passes through the flexible float line to the outlet.



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POST SCRIPTS OF INDUSTRY

NEWS · VIEWS · TRENDS

The Aro Equipment Corporation of Bryan, Ohio, has purchased **Pyles Industries, Inc.** of Detroit, Mich. This new corporation will bear the name of Pyles Industries, Inc., Subsidiary of Aro Equipment Corporation. It has nation - wide sales distribution through their own trained field engineers. Manufacturing facilities and sales offices will remain in Detroit.

George S. Pyles

George S. Pyles will continue as president of the company, which he founded. Prior to the founding of his company in 1943, he was with Fisher Body Division of the General Motors Corporation, where he served as plant engineer, standards superintendent and later as manager of one of their plants. The officers and directors of the new subsidiary, as announced by Aro, will include executives from both companies: George S. Pyles, president; R. W. Morrison, vice president; L. L. Hawk, treasurer; J. R. Markey, secretary; M. J. Anderson, director.

Appointment of **Donald C. Howard** as factory representative for the **New York Belting and Packing Co.** in California, Nevada and southern Oregon, was announced by W. A. Lindfors, sales manager of the company.

Pierce Rubber Products Company, Inc. has been formed as a wholly owned subsidiary of Plastic and Rubber Products Co. Office and warehouse of the new subsidiary are located at 820 North State Street, Chicago, Illinois. M. A. Brown is the Chicago representative.

The Hydraulic Press Mfg. Company, Mount Gilead, Ohio, announces that their Chicago office is now located at 3058 Peterson Building, Peterson Avenue, Chicago. Continuing in charge of the Chicago office is **Don C. Youngblood,** H-P-M district manager.

Arthur W. McGuire has been named to the position of assistant sales manager, **Arrowhead Rubber Company,** Downey, Calif., according to an announcement of E. F. Noyes, sales manager. Mr. McGuire, a graduate of Carnegie Institute of Technology, has had an extensive experience in the industrial sales field, coming to Arrowhead Rubber Company from Chicago Metal Hose Corp., where he was sales manager of the aircraft division.

The Watson-Stillman Company of Roselle, N. J. announced the appointment of **Adolph J. DeMatteo** to the position of chief engineer. Mr. DeMatteo graduated from New York University in 1942 with a B.M.E. degree. He joined the company in 1944 and since 1946 has held the position of assistant chief engineer.

R. B. Blyth and **J. R. Markey** have been appointed to new executive positions with **The Aro Equipment Corp.,** Bryan, Ohio, it was announced by R. W. Morrison, vice president. Mr. Blythe, formerly sales manager of the Aircraft Division, has been made executive chief engineer of the Bryan factory. Mr. Markey has been appointed sales manager of the Aircraft Division, and will be responsible for all sales activities within the division.

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PEMACO HYDRAULIC AND AIR CYLINDERS with the NEW Cartridge Type Packing Gland

Designed to J. I. C. Hydraulic Standards

Pemaco Hydraulic Cylinders are soundly engineered—give long life and top performance. The steel ram is hardened to 50.C Rockwell, ground and lapped. NOW the Pemaco has the first self-contained Cartridge Type Packing Gland.

This new Pemaco "EASY-PAK" Gland is designed to comply with J.I.C. Standards. It combines double bearing surface, low friction ram seal, and a ram wiper into a single compact unit. Easily maintained, the Pemaco "EASY-PAK" Cartridge Type Packing Gland can quickly be replaced in most cases without removing the cylinder from the machine — and by inexperienced help — greatly reducing machine down-time.

Pemaco "EASY-PAK" Cartridge Type Packing Glands are manufactured for both hydraulic and air cylinders.

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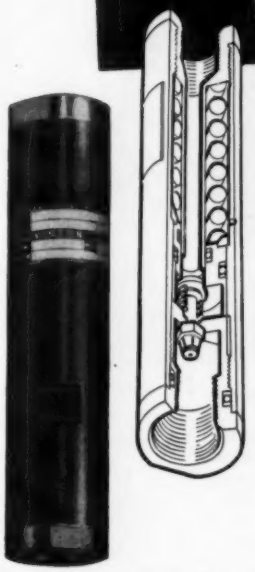

For pressures to 3000 psi

The new exclusive Vinson design is completely balanced and indifferent to pressure changes or surges down stream. Its operation is silent and smooth with no chatter, no squeal, no screech. Manufactured in four sizes 1/4", 3/8", 1/2" and 3/4", the valve is offered in three configurations.

1. Standard unit with reverse flow checked.
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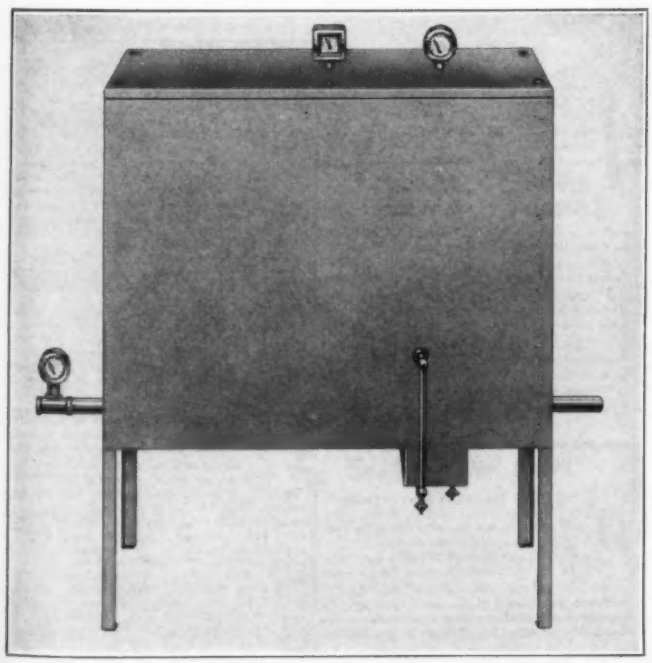
NEW HOUDAILLE WATER-OIL SEPARATOR FOR HYDRAULIC SYSTEMS

Maintains Clean, Dry Oil . . . Prolongs Safe-Use Life Indefinitely



Simplicity of design and efficient, economical operation are featured in Honan-Crane's new Houdaille Water-Oil Separator for hydraulic, turbine, quenching oils, etc.—any oil purification problem where water is a troublesome factor.

The Separator reduces water content of the oil to an insignificant trace, approximately one-tenth of one percent. Provides for the first time, a simple, practical method of separating water from oil.

New unit eliminates the necessity for changing or discarding oil regardless of the type of contamination encountered. This is possible because it **performs a complete filtering service**, removing solid contamination, acids, and other sludge-forming products of oxidation, **as it separates** the water. Continuous operation of the Separator on by-pass circulation keeps the oil in safe operating condition indefinitely.

The Separator has a filtering unit, thermostatically controlled heating and settling tank with specially designed metal screen, and an oil purifying unit employing either fullers earth or cellulose fibre. Unit is easy to install, simple to operate. Both inlet and outlet pipes of Separator easily connected by a single plug to any convenient electrical outlet. **Equipment Bulletin with complete details available on request. Write today to Honan-Crane Corporation, a subsidiary of Houdaille-Hershey Corp., 102 Wabash Ave., Lebanon, Indiana.**

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JENKINTOWN PENNSYLVANIA

J. Robert Simpson III has joined J. R. Simpson & Company, Chicago representatives for **Conoflow Corporation,** Philadelphia. Bringing with him five years experience as sales engineer for Conoflow Corporation, Mr. Simpson will join his father as a partner in the Chicago firm.

Flexonics Corporation, located at 1315 South Third Street, Maywood, Ill. is the new name for the Chicago Metal Hose Company.

Appointment of **Robert J. Minshall** as president and general manager and of **G. V. Patrick** as vice president and assistant general manager of the Marvel-Schebler Products Division of Borg-Warner Corp. has been announced. Mr. Minshall also is president of the Pesco Division of Borg-Warner at Bedford, Ohio, and the Wooster Division at Wooster, Ohio. Mr. Patrick, who joined Borg-Warner in 1948 as eastern sales manager for Pesco was transferred to Decatur in September, 1950, as assistant general manager of the newly established Marvel-Schebler Products plant.

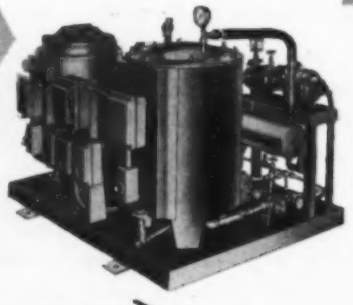
1952 A.S.T.E. Industrial Exposition

The 1952 Exposition of the American Society of Tool Engineers will be held in the International Amphitheatre, Chicago, March 17-21. Industrial sessions, which will be held simultaneously, will tie in with special fields of interest featured each day; Inspection and Quality Control Day; Metal Cutting Day; Materials Forming Day; Grinding and Finishing and Machine Accessories; and Drives and Controls Day.

One of the outstanding features will be an exhibit of quality control equipment. The South Hall, second floor at the International Amphitheatre, has been allocated to exhibits of instruments, inspection equipment, gaging and measuring equipment, charts and related quality control equipment.

The number of space reservations by exhibitors already exceeds the former record breaking number at the 1950 Exposition held in Philadelphia.

Restores used hydraulic oil to like-new condition



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Capacities from 25 to 600 g.p.h.

Protects your hydraulic equipment—lengthens oil life without high maintenance cost of centrifuges. The Hoffman Oil Conditioner consists of a cartridge filter and vaporizer, mounted on a common base, portable if desired. Complete with all necessary electric and pump connections. Only two moving parts—no steam or water connections. Write for technical bulletins.

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CANADIAN PLANT: CANADIAN HOFFMAN MACHINERY CO., LTD., NEWMARKET, ONT.

Circle 67 on Reader Service Card

SAVE UP TO 85% in WAR SURPLUS HYDRAULICS

SPECIAL BARGAIN
#29 HYDRAULIC CYLINDER
Gives 20,000 lbs. thrust (push pull) using 1500 PSI line pressure as obtained from our hyd. pumps. Or will produce 40,000 lbs. thrust with 3,000 lbs. line pressure. CAN ALSO BE OPERATED ON LOW PRESSURE AIR SYSTEMS. 4" Bore, 1½" dia. piston shaft, 18" stroke, length 30½". Equipped with ball bearing loaded clevis type mounting and swivel type high pressure steel pipe bracket for easy use. Ideal for road farm and shop machinery, presses, etc. Cost Government $390.00 . . . . . NOW 29.95

3A HYDRAULIC CYLINDERS
NO. 3A – Bore 1½", Shaft ½" Stroke 5", Length 10½" . . . 7.75
NO. 9E – Bore 1-3/8", Shaft 1" Stroke 15-5/8", Length 15⅝" 9.75
NO. 35 – Bore 1½", Shaft 1" Stroke 26", Length 23½" 16.50

AN-Hi-PRESS. HOSE
(FUEL–OIL & AIR)
1/4" Tube Size – 7/16 x 20 Thread – 16" long with Male and Female fitting at either end. . .95¢ each.
1/4" Tube Size – 7/16 x 20 Thread – 22" long with Female fittings at both ends. . . . . .95¢ each.
3/8" Tube Size – 9/16 x 18 Thread – 20" long with Female fitting at both ends. . . . . $1.90 each
Same as above but 63" long. . . . . $3.75 each
½" Tube Size – 3/4 x 16 Thread – 24" long with Female fittings at both ends. . . . . $2.65 each
Same as above but 67" long. . . . . $3.75 each
5/8" Tube Size – 7/8 x 14 Thread – 15" long with Female fittings at both ends. . . . . $2.25 each

HYDRAULIC TRANSMISSION
Self contained, 2 H.P. constant torque at all speeds with variable volume reversible, piston pump (controlled by outside lever.) supplying piston hydraulic motor. Automatic pressure, Dash pot for smooth control. Power output R.P.M. – 0 to 1/3 input R.P.M. in both directions. Input R.P.M. 1800 continuous 4000 intermittent. Dash pot can be removed for greater R.P.M. Ideal for Lathes, Duplicater Setup on Mills, Conveyors, Small Cars, Drives, Gearing, etc. Includes 2 - 4" Spline Shafts for input and power take-off. Cost Government approx. $400.00 37.50

HYDRAULIC PUMPS
ANGLE PUMP
Positive displacement type, angle piston. Displaces .507 cu.in. per revolution. Has capacity of 6 gal. per minute at 3000 RPM at 1500 PSI continuous 1875 for 15 seconds. Operating speed of 3750 RPM. Intermittent maximum 4500 RPM. Rotates to the right only. 19.49

P–3 STRATO POWER PUMP With built-in variable flow control valve in head. Positive displacement piston type. Displaces .450 cu. in. per revolution. Two gal. per minute capacity at 1500 RPM at 1250 PSI. Pressure limit, 1250 PSI continuous. 1400 PSI for 15 seconds. Operates at 3750 RPM, intermittent max. 4500 RPM. Rotation either direction without adjustments. 17.50 NEW

FOUR WAY VALVE
V-17 Poppet type. Pressure balanced. Off at neutral position. Piston type with built-in relief valves for limit of cylinder strokes. Has 5/8" AN tube size (7/8"–14 thread) inlet and outlet. Ports to the cylinder are 1/2" AN tube size with 3/4"–16 thread. Many more in stock. Send for list. 9.75

HYDRAULIC ACCUMULATORS
A–28 FLOATING PISTON TYPE – 4" dia. X 18" long. Handles pressures up to 2000 lbs. Xlnt. Cond. 12.75
4-5 VICKERS. – 10" dia. Built to stand 2,000 PSI. 19.75
Accumulators are used for constant pressure, both in line and reserve storage for instant use to take the lag from the pumps.

We carry the World's Largest Supply of New Hydraulic Equipment featuring over 20,000 Cylinders in 61 Sizes & Types. Can also supply all accessories such as Pumps, Fittings, Valves, Tanks, Hose Fittings. Let us solve your Hydraulic problems. Write for inform.

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Justus B. Stevens, a member of the **Sealol Corporation** organization for over eleven years, has now been appointed vice president and chief engineer of the Providence company. Mr. Stevens first served Sealol in the capacity of draftsman-engineer. More recently he has been responsible for the design and development of Sealol mechanical rotary shaft seals.

J. B. Stevens

William L. Parlon has been named general manager of **Elbeeco, Inc.,** wholly owned subsidiary of **Aeroquip Corporation,** Jackson, Michigan. Parlon joined Aeroquip in June 1951 as a project engineer.

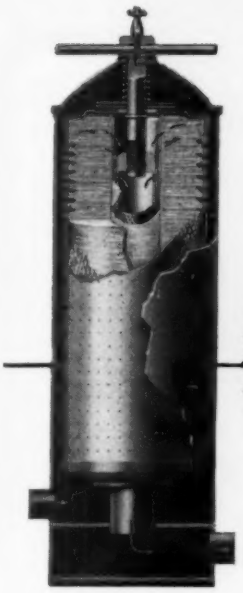
Peter F. Hurst, president of Aeroquip Corporation also announced the appointment of **Francis M. Davison** as assistant treasurer.

The appointment of **L. J. Smith** to the newly-created position of Eastern Regional Sales Manager has been announced by G. R. Winder, vice-president and general sales manager of the **Chiksan Company,** Brea, Calif. Mr. Smith's headquarters will be the company's Newark, New Jersey office, where he has served as a field engineer for the past four years.

The Cleco Division of the Reed Roller Bit Company, Houston, Texas, has announced the appointment of Cherokee Tool & Supply Company, Jacksonville, Texas; Portable Tool Engineering Co., Detroit, Mich.; and Universal Shellac & Supply Co., 425 Morgan Ave., Brooklyn 6, N. Y. as distributors.

Richard D. Maystead, vice president of manufacturing and director of engineering, **Pacific Airmotive Corporation,** today announced the appointment of **M. A. Wachter** as division manager of manufacturing, and **D. R. Wetmore** as assistant division manager of manufacturing.

Circle 69 on Reader Service Card



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HILCO FILTERS WILL PREVENT SLUDGING, PUMP AND VALVE FAILURES . . .

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TEMPORARY LUBRICATION FAILURES NEEDN'T BE EXPENSIVE

Medium and High-Lead

PROMET THE Engineered BRONZE **BRONZES**

No. 1, No. 2-S, No. 18, No. 6, No. 6-SK, No. 18-N, No. 18-R carry on until lubrication can be restored.

Hard and strong enough to take the constant pounding of heavy shock loads and high compressive forces, these Promet Bronzes are also sufficiently high in lead content, soft enough, to prevent seizure and to embed harder particles that would ordinarily result in scoring.

Easily machined at high speeds without lubricants or coolants.

Write today for service data sheets and quotations.

THE AMERICAN CRUCIBLE PRODUCTS CO.

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Circle 71 on Reader Service Card

An EASIER WAY
To Remove Packings
Use DURA HOOKS

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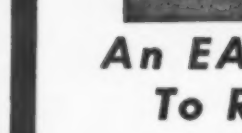
★ All Steel Flexible shaft
Tempered tool steel corkscrew bit

The PERFECT SEAL

DURAMETALLIC CORPORATION
KALAMAZOO MICHIGAN

DESIGNERS' DREAM COME TRUE!

The New VALVAIR
SOLENOID
PILOT VALVE



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- OVER 20,000,000 CYCLES
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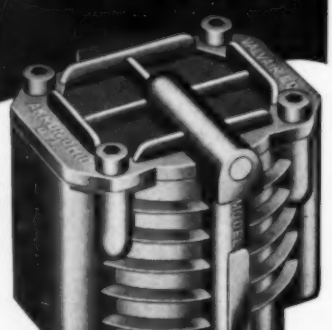
- NO OVERHEATING
- MANIFOLD MOUNTING AVAILABLE

SIZE: ¼" pipe tap, orifice ⅛" or 3/16".



Write for new Bulletin A-2.

The NEW Valvair Solenoid Pilot Valve is offered in 2-way and 3-way models, normally open or normally closed. Coils are completely sealed. Only two moving parts: spring and plunger. Valve life is almost unlimited.

VALVAIR CORPORATION • 951 Beardsley Ave., Akron 11, Ohio
Affiliate: Sinclair-Collins Valve Company

Rely Upon Valvair
2-WAY 3-WAY 4-WAY

Circle 72 on Reader Service Card

Charles B. Cushwa, Jr. has been elected president of **The Commercial Shearing and Stamping Company,** succeeding his late father whose death on December 8th left the position vacant.

Herbert B. Wollison, vice president of the company's subsidiary, Commercial Shearing & Stamping, Inc., the company's Chicago operation, was elected vice president of the parent company as well, and also was elected to the Board of Directors of both companies. **Ivory C. Jones** comptroller of the present company, was also elected secretary, and **Wilbur J. Clarke** becomes assistant treasurer as an assistant vice president. **Ward Beecher** succeeds the late Mr. Cushwa as chairman of the Board of Directors of Commercial Shearing & Stamping, Inc.

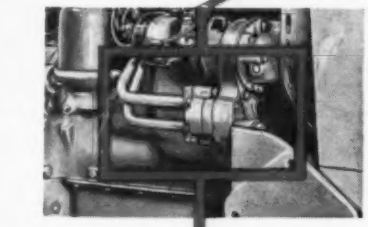
J. H. King, vice president of **The Babcock & Wilcox Company** has been named to head the reorganized boiler division of the company and **Luke E. Sawyer** and **Edward A. Livingstone,** president and vice president respectively of the recently absorbed subsidiary Tube Company have been elected vice presidents of The Babcock & Wilcox Company. The recent merger of B&W Tube company with the B&W company does not alter the present Tube Co. organization. It will operate as the Tubular Products Division, with general offices at Beaver Falls, Pa.

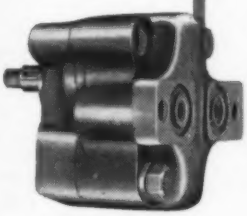
The Mechanical Rod Packing and Building Maintenance Divisions of **The Flexrock Company,** Philadelphia, Pa. announce the appointment of **Hinds & Associates, Inc.** of Kansas City, Missouri as their exclusive representative in the states of Kansas, Nebraska, Oklahoma, Arkansas, and Western Missouri.

In a transaction reportedly involving $4 million, 96-year old Crane Co. of Chicago has acquired the assets of **Hydro-Aire** of Burbank, Calif., and will operate it as a subsidiary. Hydro-Aire is a producer of aircraft hydraulic, pneumatic and electric components. **H. H. Rhoads** and **J. H. Overholser,** partners in Hydro-Aire, will be president and vice president, respectively, of the company.

PESCO HYDRAULIC POWER

ON FARMALL SUPER C TOO!





Small, compact, weighing only 3 lbs. Pesco hydraulic pump Model 051012 operates at 1200 psi and will pump 4½ gal. per minute at 2800 rpm.

For rugged, dependable duty in the fields, the powerful Farmall Super C tractor is equipped with a Pesco hydraulic pump. This pump powers the hydraulic system that gives complete finger-tip control of the tillage tools . . . control that makes farm work easier . . . lessens time spent in the fields. International Harvester uses smooth Pesco hydraulic power to do the heavy work on Farmall Cub, Super A and Super C. This is because Pesco hydraulic engineers have developed hydraulic pumps that give top-flight performance with little or no maintenance.

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